# PHILOSOPHICAL TRANSACTIONS.

GIVING SOME

# ACCOUNT

OF THE

Preſent Undertakings, Studies, *and* Labours,

OF THE

# INGENIOUS,

IN MANY

Conſiderable Parts of the WORLD.

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VOL. XLI. Part I. For the Years 1739, 1740.

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*LONDON:*

Printed for T. WOODWARD, and C. DAVIS, over-
againſt *Gray's-Inn-Gate* in *Holbourn*; PRINTERS
to the ROYAL SOCIETY. M.DCC.XLIV.

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VOL. XLI. Part II. For the Years 1740, 1741.

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Numb. 461.

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*November* and *December*, 1741.

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## *ERRATA.*

N° 456. in the Contents, Art. V. for —— read *John Machin*, Eſq; *Sec.* R. S.

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N° 458. p. 492. l. 29. for *Emmory* read *Emelie.*

N° 459. p. 630. Art. XV. *Mercurius a Venere* ſublatus. Vide ſupra N° 450. p. 394.

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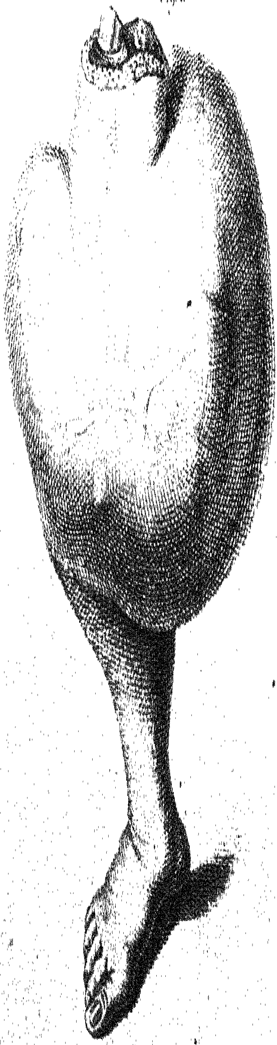
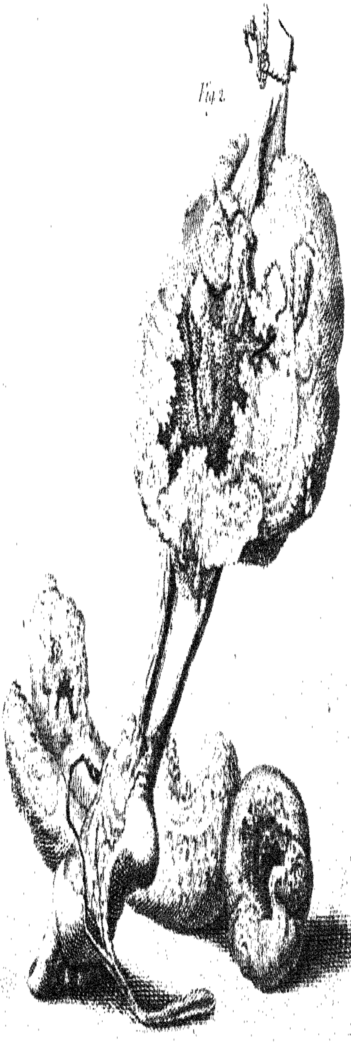


Fig. 2.



A Scale of Inches

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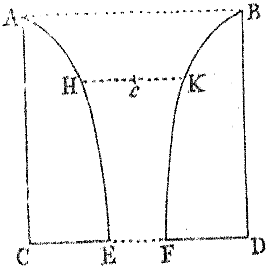
T. Ross pinx.

J. Mynde deli et Sculp.

*Phil. Trans. Nº 452.* TAB

*Fig. 1.*



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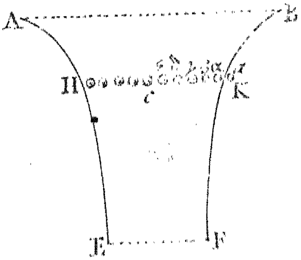
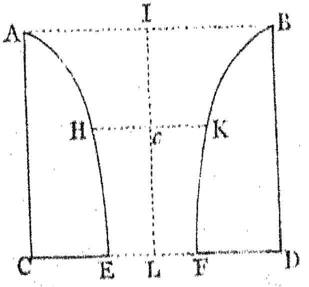


*Fig. 3.*



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# PHILOSOPHICAL TRANSACTIONS.

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II. *De Menſura & Motu Aquarum fluentium. Tentamen Primum. Quo agitur de aqua effluente ex vaſe ſemper pleno per foramen rotundum, & de reſiſtentia ejuſdem ex defectu lubricitatis oriunda. Auctore* Jacobo Jurin, *Soc. Reg. & Coll. Medic.* Londinenſ. *Sodale.*

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III. *Dias* Antrorum *mirabilis Naturæ*, glacialis *alterius*, *alterius* Halitus noxios *eructantis*, *ad* Regiam Societatem *Scientiarum* Londinenſem, *a* Matthia Belio *Pannonio*, *R. S. S. miſſa.*

IV. *An Account of a very extraordinary* Tumour *in the Knee of a Perſon, whoſe Leg was taken off by Mr.* Jer. Peirce, *Surgeon at* Bath; *communicated in a Letter to Dr.* Mead, *Phyſician to His* MAJESTY, *and Fellow of the* College of Phyſicians, *and of the* Royal Society, London.

V. *An Experiment concerning the* Spirit of Coals, *being part of a Letter to the Hon.* Rob. Boyle, *Eſq; from the late Rev.* John Clayton, *D. D. communicated by the Right Rev. Father in God* Robert *Lord Biſhop of* Corke *to the Right Hon.* John *Earl of* Egmont, *F. R. S.*

VI. *An Experiment concerning the* nitrous Particles *in the* Air; *by the ſame Hand.*

VII. *Extract of a Letter from* John Rutty, *M. D. to Dr.* Mortimer, *Sec.* R. S. *concerning the* Poiſon of Laurel-Water.

# *BOOKS lately printed for* T. WOODWARD, *at the* Half-Moon, *between the* Temple Gates, *and* C. DAVIS, *in* Pater-noſter-row; *Printers to the* ROYAL SOCIETY.

I. THE Elements of the Art of Aſſaying Metals. In Two Parts. The firſt containing the Theory, the ſecond the Practice, of the ſaid Art. The Whole deduced from the true Properties and Nature of Foſſils; confirm'd by the moſt accurate and unqueſtionable Experiments, explain'd in the natural Order, and with the utmoſt Clearneſs. By *John Crammer*, M. D. Tranſlated from the *Latin*, illuſtrated with Copper Plates. To which are added, Several Notes and Obſervations, not in the Original, particularly uſeful to the *Engliſh* Reader. With an Appendix, containing a Liſt of the chief Authors that have been publiſhed in *Engliſh*, upon Minerals and Metals.

II. A Treatiſe of Diſeaſes in General; wherein the true Cauſes, Natures, and Eſſences, of all the principal Diſeaſes incident to the Human Body, are mechanically accounted for and explained, and their reſpective Intentions of Cure aſſign'd upon the ſame Principles. To which is ſubjoined, A Syſtem of Practice, applied to each Diſeaſe, and conſtituted upon the ſame moſt legitimate and ſolid Principles of Mechanical Reaſoning. The Preſcriptions, in *Engliſh*, all render'd familiar to every Capacity; and digeſted (for Method's ſake) into ſeven Books. With an Appendix, containing a Philoſophical Eſſay on the Nature, Properties, Action, Uſe and Abuſe of Quickſilver. Comprehending likewiſe a curſory View of the wonderful Virtues and Properties of Antimony and Steel. In Two Volumes. By *Charles Perry*, M. D.

III. A Treatiſe of the Foſſil, Vegetable, and Animal Subſtances, that are made Uſe of in Phyſic. Containing the Hiſtory and Deſcription of them; with an Account of their ſeveral Virtues and Preparations. To which are prefixed, An Enquiry into the conſtituent Principles of mixed Bodies, and the proper Methods of diſcovering the Nature of Medicines. By the late *Steph. Fr. Geoffroy*, M. D. Chemical Profeſſor in the Royal Academy of Sciences, and Fellow of the Royal Society. Tranſlated into *Engliſh* by *G. Douglas*, M. D.

IV. Huſbandry and Trade improved. Being a Collection of many valuable Materials relating to Corn, Cattle, Coals, Hops, Wooll, *&c.* With a complete Catalogue of the ſeveral ſorts of Earths, and their proper Product; the beſt ſorts of Manure for each; with the Art of Draining and Flooding of Lands; as alſo full and exact Hiſtories of Trades, as Malting, Brewing, *&c.* The Deſcription and Structure of Inſtruments for Huſbandry and Carriages, with the Manner of their

Improvement: An Account of the Rivers of *England*, &c. and how far they may be made Navigable; of Weights and Meaſures of Woods, Cordage, and Metals; of Building and Stowage, the Vegetation of Plants, *&c.* with many other uſeful Particulars, communicated by ſeveral eminent Members of the Royal Society, to the Collector *John Houghton*, F.R.S. Now reviſed, corrected, and publiſhed, with a Preface, and uſeful Indexes, by *Richard Bradley*, F.R.S. and Profeſſor of Botany in the Univerſity of *Cambridge*. In 4 Vols. 8vo.

V. Philoſophical Experiments: Containing uſeful and neceſſary Inſtructions for ſuch as undertake long Voyages at Sea. Shewing how Sea-Water may be made freſh and wholſome; and how freſh Water may be preſerved ſweet. How Biſcuit, Corn, *&c.* may be ſecured from the Wheevel, Meggots, and other Inſects. And Fleſh preſerved in hot Climates, by ſalting Animals whole. To which is added, An Account of ſeveral Experiments and Obſervations on Chalybeate or Steel-waters; with ſome Attempts to convey them to diſtant Places, preſerving their Virtue to a greater Degree than has hitherto been done. Likewiſe Propoſals for clearing away Mud, *&c.* out of Rivers, Harbours, and Reſervoirs. Which were read before the *Royal Society* at ſeveral of their Meetings, by *Stephen Hales*, D. D. *F. R. S.* Rector of *Faringdon* in *Hampſhire*, and Miniſter of *Teddington*, *Middleſex*.

VI. Vegetable Eſſays; containing Vegetable Staticks: Or, An Account of ſome Statical Experiments on the Sap in Vegetables. Being an Eſſay towards a Natural Hiſtory of Vegetation, of Uſe to thoſe who are curious in the Culture and Improvement of Gardening, *&c.*

VII. Statical Eſſays; containing Hæmaſtaticks, or an Account of ſome Hydraulick and Hydroſtatical Experiments made on the Blood and Blood-veſſels of Animals, *&c.* Theſe Two by the Rev. Dr. *Hales*.

VIII. Dr. *Lobb*'s Treatiſe of the Small-pox, recommended by Dr. *Boerhaave*.

IX. A Treatiſe of the Venereal Diſeaſe, in Six Books; containing an Account of the Original, Propagation, and Contagion of this Diſtemper in General: As alſo of the Nature, Cauſe and Cure of all Venereal Diſorders in Particular, whether Local or Univerſal. Together with an Abridgment of the ſeveral Diſcourſes which have been written upon this Subject, from the firſt Appearance of the Venereal Diſeaſe in *Europe*, to this Time, with critical Remarks upon them. Written originally in *Latin* by *John Aſtruc*, Phyſician to his preſent Majeſty the King of *France*, *Auguſtus* II. late King of *Poland*, and to his Highneſs the preſent Duke of *Orleans*, and now tranſlated into *Engliſh* by *William Barrowby*, M. B. in Two Vol. 8vo.

To the HONOURABLE
*Sir* HANS SLOANE, *Bar*$^{t.}$ *M. D.*
Late
PRESIDENT *of the* ROYAL SOCIETY, *and*
ROYAL COLLEGE *of* Phyſicians, LONDON;
*Firſt* Phyſician *to His* MAJESTY;
Member *of the* Imperial Academy *of* Sciences
*at* St. PETERSBURGH,
*The* ROYAL ACADEMIES *of* SCIENCES
*at* PARIS, MADRID, *and* BERLIN,
And
Fellow *of the* ROYAL COLLEGE *of* Phyſicians *at* EDINBURGH, *&c.*

*SIR,*

I CANNOT ſufficiently extol that eminent Zeal you have ſhewn on all Occaſions for the Promotion of *Natural Knowledge*, the preſent Perfection of which is greatly indebted to your Labours and Patronage. The noble

noble and immenſe Collection you have made of the moſt rare and valuable Curioſities, and a Library the moſt complete in the Univerſe, in all the Branches of Natural Hiſtory and Phyſic, have not only been a Treaſure to yourſelf, but a common Benefit to Mankind; your generous Diſpoſition having conſtantly led you to communicate their Uſe to whoever at home or abroad was deſirous to improve himſelf, or to inform the reſt of the World.

As your great Knowledge and Skill in your own Profeſſion, brought you into the higheſt and moſt extenſive Practice for a long and uninterrupted Courſe of Years, ſo your Merit and Reputation could not fail of ſetting you at the Head of thoſe two learned Bodies, you had ſo much loved and ſerved, the *Royal College* of *Phyſicians*, and the *Royal Society* of *LONDON*, over which you preſided with ſo much Dignity and Honour.

YOUR Favours to the *Royal Society* in particular, have been too many to be here mentioned;

tioned; and your Regard for that Body hath ever been conſpicuous, by your conſtant and diligent Application to their Affairs, in the midſt of the greateſt and moſt neceſſary Avocations; yet ſuch has been your Modeſty, that you have lately, to our general Regret, reſigned the Office of Preſident, which you could not be induced to hold any longer, when you began to apprehend the Infirmities of a venerable Age might oblige you to be leſs conſtant in your Attendance on the Duties of it.

GIVE me Leave, Sir, in this Place, alſo to record my own Thankfulneſs to you, by whoſe Recommendation I at firſt obtained the Honour of being choſen one of the Secretaries of the *Royal Society*, which hath been ſo many Years continued to me; an Employ, I hope, I have diſcharged, at leaſt, with Diligence and Fidelity, and ſhall always endeavour ſo to do: I beg of you to take under your Protection thoſe Volumes of Papers ſent to the *Royal Society*, that have been publiſhed under my Inſpection, and particularly to Patronize this *Forty-firſt* Volume of the *Philoſophical Tranſactions*, which ends with the laſt Year of your Preſidentſhip. I remain,

Honoured SIR,

*Your much devoted*
*and obliged*
*Humble Servant,*

*Dartmouth-ſtreet,*
*WESTMINSTER,*
*Dec.* 31. 1741.

CROMWELL MORTIMER, *M.D.*
Secretary *to the* ROYAL SOCIETY, *and*
Fellow *of the* ROYAL COLLEGE *of*
PHYSICIANS *LONDON.*

## 1. *A* Catalogue *of the* FIFTY PLANTS *from* Chelſea Garden, *preſented to the* ROYAL SOCIETY *by the Company of* Apothecaries, *for the Year* 1737. *purſuant to the Direction of Sir* Hans Sloane, *Bart. Med. Reg. & Soc. Reg. Præſ. by* Iſaac Rand, *Apothecary, F. R. S. Hort. Chel. Præſ. ac Prælec. Botan.*

751. ACETOSA Ægyptia; roſeo ſeminis involucro; folio lacero; *Lippi. D. Shaw Phyt. Afr. Spec.* N°. 5.

752. Adianthum nigrum; radice prælonga, arbores annoſas perreptante. *Griſ. Virid. Luſitan.*

*Filicula Luſitanica; Polypodii radice.* T. Inſt. 541.

753. Admirabilis Peruviana; flore rubro. *Cluſ. rar. Plant. Hiſt.* Lib. V. p. 89. *Sloan. Cat. Jam.* 91.

754. Androſæmum maximum fruteſcens. *C. B.* 280.

755. Aralia Canadenſis. *T. Inſt.* 300.

*Panaces* κάρπιμον *ſive racemoſa, Canadenſis.* Cornut. 74.

756. Aſtrantia major; corona floris candida. *T. Inſt.* 314.

757. Aſtrantia major; corona floris purpuraſcente. *T. Inſt.* 314.

758. Betonica Orientalis; folio anguſtiſſimo, & longiſſimo; ſpica florum craſſiori. *T. Cor.* 13.

759. Bidens Americana triphylla; foliis anguſtis, acutis.

*Chryſanthemum Virginianum, folio acutiore lævi trifoliato; ſeu Anagyridis folio.* H. Ox. III. p. 21.

760. Campanula pentagonia, perfoliata. *Moriſ. H. Ox. II.* 457.

761. Caſſine vera perquam ſimilis, Arbuſcula Phillyreæ foliis antagoniſtis. Ex Provincia Carolinienſi. *Pluk. Mantiſſ. p.* 40. *Phytogr. Tab.* 381. *Fig.* 3.

762. Cepa ſiſſilis. *Matthiol.* 555.

763. Cepa Aſcalonia. *Matthiol.* 556.

764. Chenopodium Ambroſioides Mexicanum fruticoſum.

765. Chriſtophoriana Americana procerior & longius ſpicata. *Dillen. H. Elt. Tab.* 67.

766. Commelina anguſtifolia procumbens.

767. Dalea. *Dni. Millar inventoris.*

768. Dentaria bulbifera. *Lob. Icon.* 687.

769. Digitalis minima, Gratiola dicta. *H. Ox. Part. II.* 479.

*Gratiola Centauroides.* C. B. 279.

770. Elichryſum; anguſtiſſimo folio. *T. Inſt.* 452.

*Stæchas citrina tenuifolia altera, ſive Italica.* J. B. III. 155.

771. Epimedium. *C. B.* 323. *Dod.* 599.

772. Eruca ſylveſtris. *Ger.*

*Eruca ſylveſtris tenuifolia perennis; flore luteo.* J. B. II. 861.

773. Eruca; Bellidis folio. *Mor. H. Ox. P. II.* 231.

774. Eupatorium cannabinum. *C. B.* 320.

*Eupatorium Avicennæ* Officin.

775. Eupatorium; folio oblongo rugoſo; caule purpuraſcente. *T. Inſt.* 456.

776. Fagopyrum erectum; ſeminibus ad angulos dentatis, ſpicatim naſcentibus. *Ex Ruſſia.*

777. Ficus Orientalis; foliis in lacinias anguſtas profunde inciſis.

*The large white Turkey Fig.*

778. Fumaria officinarum & Dioſcoridis. *C. B.* 143.

779. Fumaria bulboſa; radice cava, major. *C. B.* 143.

780. Fumaria lutea. *C. B.* 143.

781. Fumaria ſemper virens & florens; flore albo. *Boerh. Ind.* I. 130.

782. Galeopſis patula ſegetum; flore purpuraſcente. *T. Inſt.* 185.

*Sideritis arvenſis rubra.* Park.

783. Hernandia; amplo Hederæ folio, umbilicato. *Plum. Nov. Gen.* 6.

*Nux veſicaria oleoſa, foliis umbilicatis, ex Inſula Barbadenſi.* Pluk. Phyt. 208. Fig. 1.

784. Hypericum Androſæmum dictum. *J. B. III.* 382.

*Androſæmum alterum hirſutum.* Colum. Ec. 75.

785. Lycoperſicon Galeni. *Ang.* 217.

786. Petiveria, Solani foliis; loculis ſpinoſis. *Plum. Nov. Gen.* 50.

*Verbenæ aut Scorodoniæ affinis anomala, flore albido; calyce aſpero; Allii odore.* Sloan. Cat. Jam. 64. *Guinea Hen-weed.* Hiſt. I. 172.

787. Pyrethrum Officinarum.

*Pyrethrum flore Bellidis.* C. B. 148.

*Chamæmelum ſpecioſo flore; radice longa fervida.* D. Shaw. Phyt. Afric. Spec. N°. 138.

788. Pyrethrum fruteſcens Canarienſe.

*Leucanthemum Canarienſe; foliis Chryſanthemi; Pyrethri ſapore.* T. Inſt. 600.

789. Rapuntium Americanum, flore dilute cœruleo. *Ac. Reg. Par.*

790. Rapuntium Virginianum; foliis oblongis; floribus parvis cœruleis, ſpica longiſſima laxa.

791. Reſeda alba. *J. B. III.* 467.

792. Reſeda criſpa Gallica. *Bocc. Rar.* 76.

793. Solanum fruticoſum bacciferum. *C. B.* 166.

794. Thlaſpidium fruticoſum; Leucoii folio, ſemper florens. *T. Inſt.* 214.

*Thlaſpi fruticoſum Perſicum; foliis Keiri, flore odorato.* Zanon. 196.

795. Trichomanes ſive Polytrichum Officinarum. *C. B.* 356.

796. Turritis vulgaris ramoſa. *T. Inſt.* 224.

*Piloſella ſiliquata Thalii.* Tab. vii.

797. Turritis Leucoii folio. *T. Inſt.* 224.

798. Turritis Leucoii folio; floribus amplioribus.

799. Ulmaria. *Cluſ. Hiſt. CXCVIII.*

*Barba Capræ floribus compactis.* C. B. 164.

800. Ulmaria; floribus in longas ſpicas congeſtis. *Boerh. Ind. Alt.* 295.

*Barba Capræ floribus oblongis.* C. B. 163.

# II. *De Menſura & Motu Aquarum fluentium.*

## Tentamen Primum.

*Quo agitur de aqua effluente ex vaſe ſemper pleno per foramen rotundum, & de reſiſtentia ejuſdem ex defectu lubricitatis oriunda. Auctore* Jacobo Jurin, *Soc. Reg. & Colleg. Medic.* Londinenſ. *Sodale.*

AQuarum fluentium *Menſuram* veteres nullam habuerunt, niſi incertam illam & fallacem, quæ, nulla velocitatis habita ratione, ſola rivi ſectione perpendiculari nitebatur. Ad veram aditum primus aperuit, centum circiter abhinc annis, *Benedictus Caſtellus, Italus, Galileo* familiaris. Is quum comperiſſet copiam aquæ per datam rivi ſectionem tranſfluentis, datam non eſſe, quod veteres crediderant, ſed proportionalem celeritati qua fertur aqua per datam ſectionem, nobili hoc invento novæ & utiliſſimæ fundamenta ſcientiæ jecit, Hydraulicæ. Hoc itaque auctore philoſophi certatim in eam diſciplinam excolendam incubuerunt, ut nemo pene fuerit a *Caſtelli* temporibus mathematicus paulo inſignior; quin aliquid operæ ad ejus incrementum contulerit, ſive experimentis inſtituendis, ſive rationibus & argumentis a priori excogitandis.

At pleriſque, utut magnis viris, propter ſummam operis difficultatem, parum feliciter res proceſſit. Nam & theoriam excolentes ea tradiderunt theoremata, quibus facto periculo refragare deprehenditur experientia; & qui experimentis capiendis operam dederunt, cum animum non adverterent ad circumſtantias quaſdam minutiores, quod iis quid momenti ineſſet nondum erat compertum, inde factum eſt, ut tum ſinguli magnopere inter ſe diſſideant, tum ab illa *Menſura*, quæ reperiri debuerat, pene omnes inſigniter aberrârint.

Cujus rei non aliud luculentius dari poteſt exemplum, quam ſimplex illud omniumque facillimum, quod reliquis fere univerſis pro fundamento eſſe conſuevit, quodque nos idcirco diligentius pertractandum ſuſcepimus, ubi aqua ex vaſe conſtanter pleno, conſtanti velocitate, per foramen circulare in fundo factum decurrit. Hic enim ex omnibus unus *Polenus* veram tradidit aquæ effluentis *Menſuram*, aut eam ſaltem, quæ ad veram proxime accedit: unus *Newtonus* verum poſuit ejus *Menſuræ* indagandæ fundamentum; verum, at a pleriſque repudiatum; a quibuſdam, diſſimulato auctoris nomine, pro ſuo venditatum.

His itaque duobus ducibus rem aggredimur, & primo quidem loco, phænomenωn nomine proponemus ea, quæ aut ipſis experimentis comparent, aut ex iiſdem, certiſſimis argumentis confirmantur: deinde ad eorum phænomenωn ſolutionem accedemus.

## *Phænomena effluxus aquæ ex foramine in fundo vaſis conſtanter pleni.*

1. Data altitudine aquæ & tempore effluendi, *Menſura* aquæ effluentis eſt fere in ratione foraminis.

2. Data altitudine aquæ & foramine, *Menſura* aquæ effluentis eſt in ratione temporis effluendi.

3. Dato tempore effluendi & foramine, *Menſura* aquæ effluentis eſt fere in ratione ſubduplicata altitudinis aquæ.

4. *Menſura* aquæ effluentis eſt fere in ratione compoſita ex ratione foraminis, ratione temporis, & ratione ſubduplicata altitudinis aquæ.

5. *Menſura* aquæ dato tempore effluentis longe minor eſt ea, quæ ex Mathematicorum theorematis vulgo elicitur. Ea nempe vulgo habetur aquæ effluentis velocitas, quam acquirat in vacuo corpus grave cadendo ex integra altitudine aquæ ſupra foramen; & hoc poſito, ſi area foraminis vocetur $F$, $A$ altitudo aquæ ſupra foramen, $V$ velocitas quam comparat corpus grave cadendo in vacuo ex iſta altitudine, $T$ tempus cadendi, & effluat aqua conſtanti hac velocitate $V$, per tempus $T$, erit $2A$ longitudo columnæ aqueæ, quæ eo tempore effluit; eritque ejus *Menſura* $2AF$. At ſi accuratiſſima * *Poleni* experimenta ad calculum revoces, copiam aquæ, quæ eo tempore effluit, non niſi $\frac{571}{1000}$ circiter hujus *Menſuræ* $2AF$ conficere perſpicies.

Hujus autem viri illuſtriſſimi experimenta, cum propter ſummam ejus diligentiam, & accurationis ſtudium, tum alio etiam nomine, reliquorum omnibus omnium præferenda cenſeo. Is ſiquidem deprehendit copiam aquæ effluentis ex vaſe per tubum cylindricum, eam quæ exiret per foramen circulare in tenui lamina factum, pari exiſtente diametro tubi & foraminis, & pari altitudine aquæ ambobus incumbentis, longe ſuperare. Idque ita ſe habere cognovit, cum tubus non fundo quidem, quod alii prius animadverterant, ſed lateri vaſis inſereretur.

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* Polenus de Caſtellis, *Art.* 35, 38, 39, 42, 43.

Eſt autem foramen vel in tenui lamina factum, pro brevi tubo cylindrico habendum. Unde patet majorem aquæ copiam ex foramine in lamina tenui facto profluere, quam quæ effluxura fuiſſet, ſi, quod aiunt, infinite parva fuiſſet laminæ craſſities. Cujuſmodi lamina cum neque haberi, nec etiam cogitatione concipi queat, relinquitur ut augeamus diametrum foraminis, quo laminæ craſſities, quam fieri commode poteſt, minimam rationem obtineat ad foraminis diametrum.

Id vero magno cum judicio præſtitit *Polenus*, cum uteretur diametro linearum 26, lamina autem non integram lineam craſſa; cum ante eum vix quiſquam adhibuerit diametrum 6 aut 7 lineas ſuperantem; aut omnino animum adverterit ad laminæ vel fundi vaſis craſſitiem, niſi quod unus *Newtonus*, pro ſumma ſua providentia, ſeſe lamina pertenui uſum fuiſſe ſcribat.

Nec foraminum ſolum, ſed vaſorum etiam amplitudini *Polenus* ſupra omnes proſpexit, quo aqua liberrime & quam minimo cum impedimento verſus foramen deſcenderet; ut nullus dubitandi locus ſit, quin *Menſuræ* ab eo captæ propius longe quam ullæ a reliquis traditæ ad verum accedant.

6. Cum, ut modo vidimus, *Menſura* aquæ effluentis prædicto tempore $T$, ſit $2AF \times \frac{571}{1000}$, eſt longitudo columnæ aqueæ, quæ eo tempore effluit, $2A \times \frac{571}{1000}$. Itaque, ſi particulæ aqueæ, quæ eodem tem-

poris puncto in foramine verſantur, ſingulæ pari velocitate proſiliant, liquet communem omnium velocitatem eam eſſe, qua percurratur tempore $T$ ſpatium $2A \times \frac{571}{1000}$, ſive velocitatem $V \times \frac{571}{1000}$. Hæc autem ea eſt, quacum aqua in vacuo proſilire poſſit ad tertiam fere partem altitudinis aquæ ſupra foramen.

7. Atqui, cum ſurſum vertitur aquæ motus, ut in fontibus ſalientibus, proſilire cernuntur fontes ad altitudinem aquæ in ciſterna pene integram. Proſilit ergo ex foramine aqua, aut aliqua ſaltem aquæ portio, cum velociate $V$ pene integra, certe velocitate multo majori quam $V \times \frac{571}{1000}$.

8. Hinc certiſſime liquet particulas aqueas, quæ eodem temporis puncto in foramine verſantur, non omnes erumpere cum eadem velocitate, ſive nullam eſſe velocitatem omnibus communem. Contrarium hactenus pro indubitato habuerunt Mathematici.

9. Ad parvam a foramine diſtantiam, venæ aqueæ erumpentis diameter multo minor eſt diametro foraminis. Nempe, ſi foraminis diameter ſit 1, erit venæ aqueæ diameter $\frac{21}{25}$, ſive 0,84 menſurante *Newtono*, qui mirabile hoc phænomenon primus animadvertit; ex menſuris *Poleno* captis erit $\frac{20}{26}$, vel $\frac{20,5}{26}$; hoc eſt, ſi diametrum intermediam ceperis, 0,78 fere.

His expoſitis, progrediendum eſt deinceps ad ſolutionem horum phænomenωn expediendam: id vero antequam fiat, ex uſu erit lectorem pauca præmonere.

1. Aquam nos non aliter conſideramus, quam ut corpus fluidum, continuum, cujus partes vi minimæ illatæ cedunt, & cedendo moventur inter ſe.

2. Per aquam effluentem intelligimus eam aquæ copiam, quæ actu ex foramine egreditur: Quod, etſi minus neceſſarium videri poſſit, monendum tamen idcirco duximus, quod in *Diſſertatione* noſtra *de Motu aquarum fluentium* ante annos circiter 24 *Actis Philoſophicis* inſerta, aquæ deſluentis nomine deſignata fuerit tota illa aquæ copia, quæ intra vas in motu conſtituta eſt, & verſus foramen deſcendit.

3. Vaſis amplitudinem pro infinita habemus, aut tanta ſaltem, ut in eo decrementum altitudinis aquæ toto temporis ſpatio, quo aqua ex foramine effluit, ſenſu percipi nequeat.

4. Aquam conſideramus ut effluentem conſtanti velocitate. Nimirum ipſo motus initio per minimum temporis ſpatium effluit aqua minori velocitate, quam mox elapſura ſit. Nos autem ipſum motus initium præterimus, & tum demum inveſtigamus aquæ *Menſuram* & *Motum*, cum integram velocitatem, quanta fieri poteſt, comparaverit. Hæc autem conſtans ſit, neceſſe eſt, dum conſtet aquæ ſuperincumbentis altitudo.

5. Fundum vaſis non aliter concipimus quam ut planum mathematicum, vel laminam ſaltem eatenus tenuem, ut ejus craſſities quaſi nulla ſit reſpectu diametri foraminis.

6. Per *Menſuram aquæ effluentis* in ſequentibus ſemper intelligimus eam aquæ copiam, quæ ex foramine erumpit illo temporis ſpatio, quo corpus grave in vacuo cadens percurſurum ſit altitudinem aquæ ſupra foramen.

7. Per *Motum aquæ effluentis* intelligimus ſummam motuum omnium aquæ particularum, quæ ſupradicto temporis ſpatio ex foramine erumpunt. Motus vero cujuſque particulæ eſt, ut factum ex ipſa particula & velocitate quacum ex foramine erumpit.

8. Quo facilius animo concipiantur ſequentia, caſus ſimpliciores primo proponemus, deinde ad magis compoſitos, ſed propius ad verum rerum ſtatum accedentes, progrediemur.

Nempe in problemate primo, quo ſimplicior evadat ſolutio, ponimus aquam ex foramine in vacuum effluere, aqueaſque particulas, dum verſus foramen deſcendunt, omni carere reſiſtentia ex defectu lubricitatis oriunda.

In ſecundo & tertio problemate ponitur adhuc effluxus aquæ in vacuo inſtitui; ſed concipimus particulas aqueas, dum verſus foramen deſcendunt, nonnullam ex defectu lubricitatis experiri reſiſtentiam, tantulam tamen, ut decrementum *Motus* aquæ ex foramine effluentis, exinde ortum, pro nihilo haberi poſſit.

In quarto & quinto, vacui poſitionem adhuc retinemus; at ſenſibile ponitur decrementum *Motus* aquæ effluentis, ex defectu lubricitatis.

Tandem in problemate ſexto & ſequentibus rem conſideramus prout revera ſe habet, cum in aëre res tranſigitur, adeo ut particulæ aqueæ reſiſtentiam ſenſibilem patiantur, non modo a ſeſe invicem per defectum lubricitatis, intra vas, ſed etiam poſt exitum e vaſe, per attritum aëris ambientis.

## PROBLEMA I.

*Definire* Motum, Menſuram, *& velocitatem aquæ in vacuum effluentis per foramen in fundo vaſis, ubi particulæ aquæ nullam patiuntur reſiſtentiam ex defectu lubricitatis.*

Dum foramen obturaculo occluditur, ſuſtinet obturaculum pondus columnæ aqueæ ipſi ad perpendiculum incumbentis. Remoto obturaculo, columna aquæ foramini ad perpendiculum imminens, cum non amplius ſuſtineatur, preſſione ſua efficiet, ut aqua per foramen defluat, & poſtquam eam ad debitam velocitatem compulerit, deinceps conſtanti ſua preſſione conſtantem aquæ effluentis velocitatem conſervabit.

Concipiendum eſt quidem, *Motum* aquæ ex foramine effluentis non a pondere ſolius columnæ perpendicularis ortum ducere, ſed partim ex hujus columnæ preſſione, partim ex preſſione aquæ circumpoſitæ derivari. Sed hoc pacto neque major neque minor ſit *Motus* aquæ effluentis, quam ſi ex preſſione ſolius columnæ perpendicularis oriretur: Non minor, quia preſſio columnæ perpendicularis, ſi non impediatur, *Motum* ſibi proportionalem generabit, impediri autem non poteſt niſi quatenus aqua circumpoſita urget aquam effluentem: non major, quia preſſio aquæ circumpoſitæ non poteſt aliquid conferre ad *Motum* aquæ effluentis, niſi tantundem demat ex preſſione columnæ perpendicularis.

Cauſa igitur adæquata *Motus* aquæ ex foramine effluentis, eſt preſſio ſive pondus columnæ aqueæ, quæ foramini inſiſtit. At vis data, quocunque modo ap-

applicetur, dato tempore datam generat *Motus* quantitatem verſus eaſdem partes, quo tendit vis. Parem itaque *Motus* quantitatem dato tempore generat columnæ incumbentis pondus in aqua effluente, atque generare poſſet eodem tempore in ipſa columna libere per vacuum cadente.

Jam quoniam, per hypotheſin, particulæ aqueæ nullam experiuntur reſiſtentiam ex defectu lubricitatis, & omnes illæ particulæ, quæ jamjam exituræ in ipſo foramine verſantur, æquali urgentur preſſione aquæ ſuperincumbentis, liquet harum omnium æqualem eſſe velocitatem.

Sit $v$ communis iſta velocitas; $a$ altitudo unde cadendo in vacuo comparetur ea velocitas; $A$ altitudo aquæ ſupra foramen; $V$ velocitas quæ comparetur cadendo in vacuo ex altitudine $A$; $T$ tempus cadendi ex eadem altitudine; $F$ area foraminis; & effluat aqua ex foramine per tempus $T$.

Jam quoniam tempore $T$ velocitate $V$ percurratur ſpatium $2A$, percurretur eodem tempore velocitate $v$ ſpatium $\frac{2Av}{V}$. Hæc itaque erit longitudo columnæ aqueæ, quæ effluit ex foramine tempore $T$; eritque magnitudo hujus columnæ, ſive *Menſura* aquæ effluentis tempore $T$, $\frac{2AvF}{V}$, & *Motus* ejuſdem erit

$$\frac{2AFv^2}{V}.$$

*Motus* autem, qui eodem tempore $T$, in columna aquea foramini inſiſtente generari poſſit, ſi ſuo ipſius pondere per vacuum feratur, ſic habetur.

Erit ejus velocitas $V$, & cum magnitudo ejuſdem ſit $AF$, erit ejus *Motus* $AFV$.

Atqui *Motus* iſte, ex ſuprapoſitis, æqualis eſt *Motui* columnæ aqueæ effluentis tempore $T$, ſive $AFV = \frac{2AFv^2}{V}$.

Hinc autem $V = \frac{2v^2}{V}$, ſive $v^2 = \frac{V^2}{2}$, & $v = \frac{V}{\sqrt{2}}$.

Porro *Menſura* ſupraposita aquæ effluentis tempore $T$, ſive $\frac{2AFv}{V} = \frac{2AF}{V} \times \frac{V}{\sqrt{2}} = \frac{2AF}{\sqrt{2}} = AF \times \sqrt{2}$. *Q.E.I.*

COROLL. I. Cum ſit $a : A :: v^2 : V^2$; erit $a = \frac{Av^2}{V^2}$, hoc eſt, $a = \frac{A}{V^2} \times \frac{V^2}{2}$, ſive $a = \frac{A}{2}$. Itaque altitudo $a$, quam effluens aqua motu ſurſum verſo attingere queat, dimidia eſt altitudo aquæ in vaſe ſupra foramen. Quæ eſt ipſa altitudo *Newtono* definita *Prop.* 36. *Lib.* II. *Princip.* Editionis primæ.

COROLL. II. Si tribuatur aquæ effluenti ea velocitas, quæ comparatur cadendo ex integra altitudine aquæ ſupra foramen, hoc eſt, ſi ponatur velocitas $v = V$, erit *Motus* aquæ ſupra definitus $\frac{2AFv^2}{V} = 2AFV$, ſivedu plus ejus *Motus*, qui a columna foramini incumbente generari poſſit, & proinde non niſi a duplo hujus columnæ generandus; quod docuit *Newtonus Corollario* ſecundo, *Prop.* 36. *Libr.* II. *Princip. Edit.* 2 & 3.

SCHO-

## SCHOLIUM.

*Menſura* hic determinata, $\frac{2AF}{\sqrt{2}}$, ſive $2AF\times 0,707$, ut longe deficit ab ea, quæ vulgo Mathematicis ſtatuitur, nempe $2AF$, ita longe ſuperat illam *Menſuram*, quam exhibent *Poleni* experimenta, ſive $2AF\times 0,571$. Nec mirum: quod enim ponitur in hoc problemate, carere omni reſiſtentia particulas aqueas inter defluendum, hypotheſis eſt a vero rerum ſtatu aliena.

## PROBLEMA II.

*Definire* Motum, Menſuram *& velocitatem aquæ in vacuum effluentis per foramen circulare in medio fundo vaſis cylindrici, ubi particulæ aquæ reſiſtentiam patiuntur ex defectu lubricitatis, ſed tam parvam, ut decrementum* Motus *aquæ effluentis exinde ortum pro nihilo haberi poſſit.*

Sit vas cylindricum immenſum $ABCD$, Fig. 1. $EF$ foramen circulare in medio fundo factum, & aqua in hoc vaſe quieſcente prorſus & immota, detrahatur obturaculum a foramine, ut pateat exitus aquæ per foramen.

Tum quoniam aqua hactenus immota fuerit, & jam per foramen effluere incipit, & effluentem ſequitur aqua ſuprapoſita, & motus naturalis aquæ nulla deſuper affuſione perturbatur, & foramen obtinet ipſum fundi medium, induet ſeſe neceſſario illa aquæ portio, quæ in motu verſatur, & verſus foramen deſcendit, in ſiguram aliquam regularem *AHEFKB*, cujus baſis inferior ſit ipſum foramen, baſis autem ſuperior ſit ſuperficies aquæ ſuprema *AB*, & ſectiones omnes horizontales ſint circulares. Hanc vocamus *Cataractam*; qualis autem ſit *Cataractæ* figura, nondum diſputamus: in præſenti ſufficit noſtro inſtituto, ut animadvertamus regularem eſſe, & per ſingulas ejus ſectiones horizontales eandem aquæ copiam dato tempore tranſire.

Jam quoniam omnis illa aqua, quæ deorſum fertur, *Cataracta* continetur, patet reliquam aquam *AHEC*, *BKFD*, quæ extra *Cataractam* ſita eſt, omni motu carere, & penitus quieſcere. Itaque in ſectione quavis horizontali *Cataractæ HcK*, cujus centrum *c*, puncta *H*, *K* repræſentabunt limites inter aquam deſcendentem verſus foramen, & aquam circumpoſitam quieſcentem.

Porro, cum punctum *K* ſit limes motus & quietis, & particulæ aqueæ, dum moventur inter ſe, reſiſtentiam patiantur ex defectu lubricitatis, particula aquæ $\alpha$, Fig. 2. intra *Cataractam* ſita, & adjacens puncto *K*, non poterit niſi quam minima velocitate deorſum ferri. Alioqui, neceſſario ſecum abriperet particulam proximam *a* extra *Cataractam* poſitam, contra hypotheſin. Particula autem $\beta$, quæ particulæ $\alpha$ introrſum contigua eſt, nonniſi quam minima velocitate relativa deſcendet reſpectu particulæ $\alpha$; cum alioqui particulam $\alpha$ accelerando eam ſecum abriperet, & hæc particula $\alpha$, jam celerius mota, abriperet ſecum particulam *a*. Pariter particula $\gamma$ magis introrſum poſita, & particulæ $\beta$ contigua, deſcendet quam minima velocitate relativa reſpectu particulæ $\beta$; & reliquæ particulæ $\delta$, $\varepsilon$, &c. aliæ aliis magis introrſum ſitæ, deſcendent velocitate quam minima relativa reſpectu particularum ſingulis extrorſum adjacentium. Hac autem ratione velocitas abſoluta particularum creſcat neceſſe eſt gradatim a limite verſus centrum $c$, ut velocitas aquæ ſit maxima in ipſo centro, minima in limite utroque $K$ & $H$.

Neceſſe vero eſt, ut reſiſtentia, quam experitur particula quæque celerior ex affrictu adjacentis particulæ tardioris extrorſum poſitæ, perpetuo ſibi æqualis ſit per totam ſectionem *Cataractæ*. Alioqui, particula illa, quæ majorem patitur reſiſtentiam, accelerabit particulam tardiorem adjacentem, donec minuatur hoc pacto reſiſtentia, & fiat æqualis illi reſiſtentiæ, quam patiuntur cæteræ particulæ. At ſi reſiſtentia ſit ubique ſibi æqualis per totam *Cataractæ* ſectionem, erit & velocitas relativa particularum ubique æqualis, cum altera alteram neceſſario conſequatur.

Ergo velocitas abſoluta cujuſlibet particulæ, quæ eſt ſumma velocitatum omnium relativarum ab ambitu ſectionis ad eam uſque particulam ſimul ſumptarum, eſt in ratione diſtantiæ ejuſdem particulæ ab ambitu *Cataractæ*.

His expoſitis, ſit modo $r$ radius foraminis, $m$ ad 1 in ratione peripheriæ ad diametrum, $mr^2$ area foraminis, $v$ velocitas quacum aqua deſcendit in centro foraminis, $a$ altitudo unde cadendo in vacuo comparetur velocitas $v$, $A$ altitudo aquæ ſupra foramen, $V$ velocitas quæ comparetur cadendo in vacuo ex altitudine $A$, $T$ tempus cadendi ex eadem, $z$ diſtantia cujuſlibet particulæ a centro foraminis, & effluat aqua tempore $T$.

Jam *Menſura* aquæ, quæ tempore $T$ ex foramine egreditur, ad hunc modum invenietur.

Erit $z$ radius circuli cujuſlibet intra foramen, $2mz$ circumferentia ejuſdem, $2mz\dot{z}$ annulus naſcens ei circumferentiæ adjacens, $\frac{v\times\overline{r-z}}{r}$ velocitas aquæ in annulo naſcente.

Cumque ſit $V : v\times\frac{\overline{r-z}}{r} :: 2A : \frac{2Av\times\overline{r-z}}{Vr}$ erit $\frac{2Av\times\overline{r-z}}{Vr}$ ſpatium, quod conficit aqua per annulum naſcentem fluens tempore $T$, & *Menſura* ejuſdem aquæ erit $2mz\dot{z}\times\frac{2Av\times\overline{r-z}}{Vr} = \frac{4mAv\times\overline{rz\dot{z}-z^2\dot{z}}}{Vr}$.

At *Menſura* aquæ per annulum naſcentem tranſeuntis eſt fluxio *Menſuræ* aquæ tranſeuntis per circulum, cui radius $z$. Eſt itaque *Menſura* aquæ, quæ tempore $T$ tranſit per hunc circulum, quantitas fluens fluxionis modo expoſitæ $\frac{4mAv}{Vr}\times\overline{rz\dot{z}-z^2\dot{z}}$, i. e. $\frac{4mAv}{Vr}\times\frac{\overline{3rz^2-2z^3}}{6} = \frac{2mAv}{3Vr}\times\overline{3rz^2-2z^3}$. Et ponendo $z=r$, habebitur *Menſura* aquæ per totum foramen tranſeuntis tempore $T$, nempe $\frac{2mAvr^2}{3V}$.

*Motus* vero aquæ ejuſdem ſic habebitur.

*Menſura* aquæ tempore $T$ effluentis per annulum naſcentem eſt, ut modo perſpeximus, $\frac{4mAv}{Vr}\times rz\dot{z}-z^2\dot{z}$, & cum velocitas ejuſdem ſit $v\times\overline{\frac{r-z}{r}}$, erit ejus *Motus* $\frac{4mAv}{Vr}\times\overline{rz\dot{z}-2z^2\dot{z}}\times\frac{v}{r}\times\overline{r-z}$ $=\frac{4mAv^2}{Vr^2}\times\overline{r^2z\dot{z}-2rz^2\dot{z}\times z^3\dot{z}}$, cujus quantitas fluens eſt $\frac{4mAv^2}{Vr^2}\times\overline{\frac{r^2z^2}{2}-\frac{2rz^3}{3}+\frac{z^4}{4}}=\frac{mAv^2}{3Vr^2}\times\overline{6r^2z^2-8rz^3+3z^4}$, qui eſt *Motus* aquæ tranſeuntis per circulum cui radius $z$. Et poſita $z=r$, habetur *Motus* aquæ effluentis tempore $T$ per totum foramen, $\frac{mAv^2r^2}{3V}$.

Hic autem *Motus*, per ſolutionem *Problematis* primi, & hypotheſin hujus, æqualis eſt *Motui*, quem columna foramini inſiſtens comparare poſſit eodem tempore $T$, ſuo ipſius pondere per vacuum cadendo, hoc eſt, *Motui* $AFV$, ſive $AV\times mr^2$. Itaque $\frac{mAv^2r^2}{3V}=mAVr^2$.

Hinc autem $v^2=3V^2$, & $v=V\times\sqrt{3}$.

Porro *Menſura* ſuprapoſita aquæ effluentis per foramen tempore $T$, nempe $\frac{2mAvr^2}{3V}=\frac{2mAr^2}{3V}\times V\times\sqrt{3}=\frac{2Amr^2}{\sqrt{3}}$. Q. E. I.

COROLL. I. Cum ſit $V^2 : v^2 :: A : a$, erit $a = \frac{Av^2}{V^2} = \frac{A}{V^2} \times 3V^2 = 3A$. Itaque altitudo, ad quam aqua in vacuo proſilire poſſit ea velocitate, quacum effluit in centro foraminis, tripla eſt altitudinis aquæ ſupra foramen.

COROLL. II. *Cataractæ* figura ad hunc modum definietur:

Sit *HK*, Fig. 3. quælibet ſectio *Cataractæ*, cujus centrum *c*, ſitque ejus radius $cK = y$, altitudo aquæ ſupra iſtam ſectionem, ſive $Ic = x$, *t* tempus cadendi in vacuo ex altitudine *x*, ſitque, ut prius, $LF = r$, & $IL = A$.

Jam tranſit aqua per hanc ſectionem *HK* eadem copia atque effluit ex foramine *EF*.

Quod ſi vas eo uſque decurtetur, ut ejus altitudo redigatur ex *IL* ad *Ic*, adeoque ſectio iſta *HK* jam fiat ipſum foramen in fundo vaſis, tranſibit aqua dato tempore, per hanc ſectionem, copia neque majori, neque minori, atque prius tranſierat per eandem, vaſe nondum decurtato: non majori, quia non urgetur iſta ſectio niſi eodem columnæ ſuperincumbentis pondere, quo prius urgebatur; non minori, quia aqua inferior *HKFE* non obſtat motui aquæ per ſectionem *HK* tranſituræ.

Vaſe autem decurtato, *Menſura* aquæ effluentis ex foramine *HK* tempore *t*, per ſolutionem præcedentem, eſt $\frac{2xmy^2}{\sqrt{3}}$, & *Menſura* aquæ effluentis tempore *T* eſt $\frac{2xmy^2}{\sqrt{3}} \times \frac{T}{t} = \frac{2xmy^2}{\sqrt{3}} \times \frac{\sqrt{A}}{\sqrt{x}}$. Nam $T : t :: \sqrt{A} : \sqrt{x}$.

Sed, ex ſupradictis, *Menſura* aquæ tempore dato $T$ effluentis ex foramine $HK$ vaſe decurtato, æqualis eſt *Menſuræ* aquæ eodem tempore tranſeuntis per ſectionem $HK$ vaſe integro, ſive *Menſuræ* aquæ eodem tempore effluentis ex foramine $EF$. Itaque $\frac{2xmy^2}{\sqrt{3}} \times \frac{\sqrt{A}}{\sqrt{x}} = \frac{2Amr^2}{\sqrt{3}}$, ſive $y^2\sqrt{x} = r^2\sqrt{A}$, vel $y^4x = r^4A$, quæ eſt ipſa æquatio curvæ hyperbolicæ, cujus rotatione figuram *Cataractæ* gigni olim oſtendimus in *Actis Philoſophicis* Numero 355.

### SCHOLIUM I.

*Menſura* aquæ ſupra inventa $\frac{2Amr^2}{\sqrt{3}}$, ſive $2Amr^2 \times 0{,}577350$ tantillo major eſt *Menſura* $2Amr^2 \times 0{,}571$, quæ ex Cl. *Poleni* experimentis elicitur. Hoc autem differentiæ, aliqua ſaltem ex parte, inde provenit, quod in hoc problemate decrementum *Motus* aquæ ex reſiſtentia ortum pro nihilo habuimus.

### SCHOLIUM II.

Recte ſe habet *Menſura* aquæ effluentis hac ſolutione definita, ſi altitudinem vaſis pro infinite magna habeamus reſpectu diametri foraminis. Cum vero hæc altitudo finitam rationem obtinet ad diametrum foraminis, paulo minor erit *Menſura*, ita tamen, ut cum altitudo quinquies major ſit diametro, non niſi parte $\frac{1}{32000}$, & cum dupla ſit diametri, non niſi parte $\frac{1}{5120}$ circiter, a vero aberret, quæ differentiæ minores ſunt quam ut ullo experimento deprehendi queant.

Tantillum autem hoc diſcrimen exinde proficiſcitur, quod velocitas ſupradicta relativa, & proinde ipſa velocitas abſoluta particularum aquæ, quas conſideravimus ut in directione ad horizontem perpendiculari, revera obtinent directionem paululum obliquam, cum propius ad axem *Cataractæ* accedat quæque particula inter deſcendendum.

Quod ſi aliquis deſiderio teneatur ſolutionem veram & accuratam conſequendi, cum altitudo aquæ quamcunque rationem obtinet ad diametrum foraminis, eam hunc in modum conſequi poterit.

Ex curvæ *Cataracticæ* proprietate corollario ſecundo hujus problematis expoſita, qua $y^4 x = r^4 A$, ſubtangens hujus curvæ ad ambitum foraminis invenietur $4A$, & ad ambitum cujuſlibet ſectionis ſubtangens erit $4x$, æqualis ſcilicet altitudini aquæ ſupra illam ſectionem quater ſumptæ.

Curvam vero ejuſmodi *Catarацticam* deſcribit non modo aqua exterior, quæ foraminis ambitum præterfluit, ſed etiam illa pars aquæ, quæ per quemlibet foraminis annulum effluit; i. e. unaquæque particula aquea curvam ejuſmodi deſcribit.

Sit modo $z$ diſtantia cujuſvis particulæ in foramine poſitæ, a centro foraminis, & deſcendat hæc particula per ſpatium quam minimum in tangente ad curvam *Cataracticam*. Hinc erit ejus velocitas in directione hujus tangentis, ſive velocitas $v \times \frac{\overline{r-z}}{r}$, quæ in hoc problemate expoſita eſt, ad velocitatem ejuſdem in directione ad horizontem perpendiculari, ut $\sqrt{16A^2 + z^2} : 4A$.

Eſt itaque velocitas in directione ad horizontem perpendiculari, $v \times \overline{r-z} \times \frac{4A}{\sqrt{16A^2+z^2}}$.

Hinc autem, inſiſtendo veſtigiis ſolutionis ſuperioris, habebis pro *Menſura* aquæ per annulum naſcentem tranſeuntis, $\frac{16mA^2v}{rV} \times \frac{rz\dot{z} - z^2\dot{z}}{\sqrt{16A^2+z^2}}$.

Hujus vero fluxionis quantitas fluens, per Menſuras rationum *Coteſianas*, Form. V. & VI. invenietur $\frac{16mA^2v}{rV} \times \overline{\frac{2r-z}{2}\sqrt{16A^2+z^2} + 8A^2 \Big| \frac{z+\sqrt{16A^2+z^2}}{4A}}$; & ponendo primum $z=0$, deinde $z=r$, habebis $\frac{16mA^2v}{rV} \times \overline{\frac{r}{2}\sqrt{16A^2+r^2} - 4Ar + 8A^2 \Big| \frac{r+\sqrt{16A^2+r^2}}{4A}}$ pro *Menſura* aquæ per totum foramen tranſeuntis tempore $T$.

Porro, ſimilem in modum procedendo, habebis pro *Motu* aquæ per annulum naſcentem tranſeuntis, $\frac{64mA^3v^2}{r^2V} \times \frac{\overline{r^2z\dot{z} - 2rz^2\dot{z} + z^3\dot{z}}}{16A^2+z^2}$, cujus fluxionis quantitas fluens, per Formam I. & II. *Coteſianam*, reperietur $\frac{64mA^3v^2}{r^2V}$ in $\frac{z^2-4rz}{2} + \frac{r^2}{2}\Big|\frac{16A^2+z^2}{16A^2} - \frac{16A^2}{2}\Big|\frac{16A^2+z^2}{16A^2} + 2r\sqrt{-16A^2}\Big|\frac{z+\sqrt{-16A^2}}{\sqrt{16A^2+z^2}}$, & ponendo $z=r$, habebis $\frac{64mA^3v^2}{r^2V}$ in $\frac{r^2-16A^2}{2}\Big|\frac{16A^2+r^2}{16A^2} + 2r\sqrt{-16A^2}\Big|\frac{r+\sqrt{-16A^2}}{\sqrt{16A^2+r^2}} - \frac{3r^2}{2}$, qui eſt *Motus* aquæ tranſeuntis per foramen tempore $T$.

Sit jam $M = \frac{r}{2}\sqrt{16A^2 + r^2}$,

$$N = 8A^2 \left| \frac{r + \sqrt{16A^2 + r^2}}{4A} \right., \text{ vel}$$

$$N = 4A^2 \left| \frac{16A^2 + 2r^2 + 2r\sqrt{16A^2 + r^2}}{16A^2} \right.,$$

$$K = \frac{r^2 - 16A^2}{2} \left| \frac{16A^2 + r^2}{16A^2} \right., \&$$

$$L = 2r\sqrt{-16A^2} \left| \frac{r + \sqrt{-16A^2}}{\sqrt{16A^2 + r^2}} \right., \text{ vel}$$

$L = 2r \times 4A$ (Rad : Tang : Sec :: $4A : r : \sqrt{16A^2 + r^2}$), & *Menſura* aquæ per foramen tranſeuntis tempore $T$, erit $\frac{16mA^2v}{rV} \times \overline{M + N - 4Ar}$; *Motus* vero ejuſdem aquæ erit $\frac{64mA^3v^2}{r^2V} \times \overline{L + K - \frac{3r^2}{2}}$.

Sed $\frac{64mA^3v^2}{r^2V} \times \overline{L + K - \frac{3r^2}{2}} = mr^2AV$, unde $v^2 = \frac{r^4V^2}{64A^2 \times \overline{L + K - \frac{3r^2}{2}}}$ & *Menſura* aquæ per foramen effluentis tempore $T$, eſt $2mAr \times \frac{\overline{M + N - 4Ar}}{\sqrt{L + K - \frac{3r^2}{2}}}$.

Sin autem pro Menſuris rationum & angulorum adhibere malis ſeries infinitas, erit ſuprapoſita *Menſura* aquæ per annulum naſcentem effluentis, $\frac{16mA^2v}{rV} \times \frac{rz\dot{z}-z^2\dot{z}}{\sqrt{16A^2+z^2}}$, ad hanc formam reducenda, $\frac{mv}{rV} \times \overline{rz\dot{z}-z^2\dot{z}} \times \frac{16A^2}{\sqrt{16A^2+z^2}}$; & reducendo $\frac{16A^2}{\sqrt{16A^2+z^2}}$ ad ſeriem infinitam, habebis $\frac{mv}{rV} \times \overline{rz\dot{z}-z^2\dot{z}}$ in $4A-\frac{z^2}{8A}+\frac{3z^4}{8^3A^3}-\frac{5z^6}{4\times 8^4A^5}+\frac{35z^8}{8^7A^7}$, — &c. pro *Menſura* aquæ per annulum naſcentem effluentis; & per hujus fluxionis quantitatem fluentem, ſive per $\frac{mv}{V}$ in $\frac{2Ar^2}{3}-\frac{r^4}{20\times 8A}+\frac{r^6}{14\times 8^3A^3}-\frac{5r^8}{36\times 8^5A^5}+\frac{7r^{10}}{22\times 8^7A^7}$, — &c. exponetur *Menſura* aquæ effluentis per foramen integrum.

Porro *Motus* ſuprapoſitus aquæ per annulum naſcentem tranſeuntis, $\frac{64mA^3v^2}{r^2V} \times \frac{r^2z\dot{z}-2rz^2\dot{z}+z^3\dot{z}}{16A^2+z^2}$

$$= \frac{4mAv^2}{r^2V} \times \overline{r^2z\dot{z}-2rz^2\dot{z}+z^3\dot{z}} \times \frac{16A^2}{16A^2+z^2}$$

$$= \frac{4mAv^2}{r^2V} \times \overline{r^2z\dot{z}-2rz^2\dot{z}+z^3\dot{z}} \text{ in } 1-\frac{z^2}{16A^2}+\frac{z^4}{16^2A^4}-\frac{z^6}{16^3A^6}+\frac{z^8}{16^4A^8}-\frac{z^{10}}{16^5A^{10}}, +\&c.$$

Et per fluxionis hujus quantitatem fluentem, ſive per

$$\frac{4mAv^2}{V}\text{ in }\frac{r^2}{12}-\frac{r^4}{60\times16A^2}+\frac{r^6}{168\times16^2A^4}-\frac{r^8}{360\times16^3A^6}+\frac{r^{10}}{660\times16^4A^8}-\text{\&c.}$$

exponetur *Motus* aquæ per foramen integrum effluentis.

Ergo $Amr^2V=\frac{4mAv^2}{V}$ in $\frac{r^2}{12}-\frac{r^4}{60\times16A^2}+$, &c.

ſive $V^2=v^2$ in $\frac{1}{3}-\frac{r^2}{15\times16A^2}+$, &c. vel

$$v^2=\frac{V^2}{\frac{1}{3}-\frac{r^2}{15\times16A^2}+\text{\&c.}}$$

$$\&\ v=\frac{V}{\sqrt{\frac{1}{3}-\frac{r^2}{15\times16A^2}+\text{\&c.}}}$$

Unde *Menſura* aquæ effluentis per foramen, ſive

$$\frac{mv}{V}\text{ in }\frac{2Ar^2}{3}-\frac{r^4}{20\times8A}+\frac{r^6}{14\times8^3A^3}-\frac{5r^8}{36\times8^5A^5}+\text{\&c}$$

$$=\frac{m}{V}\text{ in }\frac{2Ar^2}{3}-\frac{r^4}{20\times8A}+\frac{r^6}{14\times8^3A^3}-\frac{5r^8}{36\times8^5A^5}+\text{\&c}$$

$$\times\frac{V}{\sqrt{\frac{1}{3}-\frac{r^2}{15\times16A^2}+\text{\&c:}}}$$

$$=m\text{ in }\frac{\frac{2Ar^2}{3}-\frac{r^4}{20\times8A}+\text{\&c.}}{\sqrt{\frac{1}{3}-\frac{r^2}{15\times16A^2}+\text{\&c.}}}$$

Unde tandem *Menſura* aquæ effluentis per foramen habetur $\frac{2Amr^2}{\sqrt{3}}$ in $1-\frac{r^2}{20\times16A^2}+\frac{r^4}{56\times16^2A^4}-$ &c

Hinc ponendo $A$ infinitam reſpectu diametri foraminis, evadit *Menſura* $= \frac{2Amr^2}{\sqrt{3}}$, ut in *Problemate* hoc determinavimus.

Cum $A = 10r$, *Menſura* $= \frac{2Amr^2}{\sqrt{3}} \times \overline{1 - \frac{1}{32000}}$ circiter.

Cum $A = 4r$, *Menſura* $= \frac{2Amr^2}{\sqrt{3}} \times \overline{1 - \frac{1}{5120}}$ circiter.

Poteſt itaque loco veræ *Menſuræ* adhiberi *Menſura* $\frac{2Amr^2}{\sqrt{3}}$, ſine periculo ſenſibilis erroris, etiam in tantula altitudine, multo magis in altitudine multis vicibus majori, qualis fere in experimentis adhiberi conſuevit; & hoc pacto computus ex operoſo admodum & intricato facillimus evadit.

## PROBLEMA III.

*Iiſdem poſitis, & negligendo accelerationem aquæ extra foramen, determinare diametrum venæ aqueæ ad parvam diſtantiam extra foramen, ubi vena maxime contrahitur, & velocitatem aquæ in vena ſic contracta.*

In problematis ſuperioris ſolutione oſtenſum fuit, particulas aqueas ex foramine erumpentes non una omnibus communi velocitate proſilire, ſed eo velocius ferri, quo propius abſunt a centro foraminis; & velocitatem relativam particularum interiorum, reſpectu particularum ſingulas extrorſum contingentium, conſtanter ſibi æqualem fieri per totum foramen; & relativam hanc velocitatem proficiſci ex reſiſtentia, quam ab aqua circumpoſita patitur aqua verſus foramen deſcendens.

At poſtquam aqua ex foramine egreſſa eſt, ejuſque ſuperficies exterior nullam jam patitur reſiſtentiam ab aqua circumpoſita, nec etiam ab aëre ambiente, quippe quæ ex hypotheſi per vacuum feratur, fieri nequit ut amplius perſtet illa velocitas relativa, aut velocitatis abſolutæ inæqualitas. Jam enim particulæ celeriores accelerent neceſſe eſt particulas tardiores contiguas, & ipſæ viciſſim a tardioribus retardentur, donec univerſæ unicam velocitatem ſortitæ fuerint particulis omnibus communem; quod intra parvum ſpatium fiet, poſtquam ex foramine fuerint egreſſæ.

Dum vero communem hanc velocitatem conſequuntur omnes particulæ, contrahitur neceſſario venæ diameter. Similiter nempe hic res accidit, atque cum flumen rapidius cum tardiori, *Rhodanus* puta cum *Arare*, conjungitur. In alveo communi par eſt velocitas aquæ ex utroque flumine advectæ, & pari copia tranſmittitur aqua per ſectionem hujus alvei, atque prius tranſmiſſa fuerat per ſectiones fluminum amborum: Sed longe minor eſt *Rhodani* ſectio poſt *Ararim* receptum, quam ſumma ſectionum *Rhodani* & *Araris*, priuſquam confluant.

Sit igitur venæ aqueæ contractæ, ubi omnes particulæ in eadem venæ ſectione ſitæ æqualem velocitatem adeptæ fuerint, radius $\rho$, & communis iſta velocitas vocetur $v$.

Jam *Menſura* aquæ per venæ contractæ ſectionem transfluentis tempore $T$ ſic habebitur.

Eſt $V : v :: 2A : \frac{2Av}{V}$, quæ eſt longitudo venæ aqueæ per hanc ſectionem tranſeuntis tempore $T$. Eſtque $\frac{2Av}{V} \times m\varrho^2$ *Menſura* aquæ per hanc ſectionem tranſeuntis eodem tempore.

Et *Motus* aquæ per ſectionem venæ tranſeuntis tempore $T$, eſt $\frac{2Av}{V} \times m\varrho^2 \times v$, ſive $\frac{2Am\varrho^2v^2}{V}$.

Atqui *Menſura* aquæ per venæ ſectionem tranſeuntis æqualis eſt *Menſuræ* aquæ per foramen eodem tempore effluentis, hoc eſt, $\frac{2Am\varrho^2v}{V} = \frac{2Amr^2}{\sqrt{3}}$, ſive $2\varrho^2v = \frac{2r^2V}{\sqrt{3}}$.

Porro *Motus* aquæ ex foramine erumpentis, cum non mutetur ex actione particularum inter ſe, æqualis erit *Motui* aquæ per venæ ſectionem transfluentis, hoc eſt $AVmr^2 = \frac{2Am\varrho^2v^2}{V}$, ſive $2\varrho^2v^2 = r^2V^2$.

Eſt autem $v = \frac{2\varrho^2v^2}{2\varrho^2v} = r^2V^2 \times \frac{\sqrt{3}}{2r^2V}$, hoc eſt $v = \frac{V\sqrt{3}}{2}$, & $v^2 = \frac{3V^2}{4}$.

Et $\varrho^2 = \frac{r^2V^2}{2v^2} = \frac{r^2V^2}{2} \times \frac{4}{3V^2}$, ſive $\varrho^2 = \frac{2r^2}{3}$, & $\varrho = \frac{r\sqrt{2}}{\sqrt{3}}$. Q. E. I.

COROLL. Cum ſit $v^2 = \frac{3V^2}{4}$, altitudines autem ſint in ratione duplicata velocitatum inde cadendo genitarum, patet eam eſſe velocitatem aquæ in vena contracta, qua ſurſum proſilire queat in vacuo ad tres quartas partes altitudinis aquæ ſupra foramen.

## SCHOLIUM I.

Mirabilem hanc venæ aqueæ contractionem primus omnium, ante annos fere 30, animadvertit *Newtonus*, cum occaſione difficultatum quarundam ab altero illo *Britanniæ* lumine, & amico noſtro nullis unquam lacrymis ſatis deflendo, *Rogero Coteſio*, propoſitarum, qui tunc temporis ſecundam *Principiorum* editionem adornabat, attentius in motum aquæ effluentis introſpiceret: eandem poſtea pluribus experimentis confirmavit *Polenus*. Exinde philoſophorum ingenia ſatis ſuperque exercuit hoc phænomenon: ſed omnes hactenus latuit vera cauſa hujus contractionis.

Radius autem venæ hoc problemate definitus, nempe $\frac{r\sqrt{2}}{\sqrt{3}}$, ſive $r \times 0{,}8165$, paulo minor eſt radio $r \times 0{,}84$, quanta a *Newtono* traditur; paulo major radio $r \times 0{,}78$, qualis fere *Poleno* menſuranti contigit, eſtque pene inter utramque intermedia.

At velocitas ſupra determinata $\frac{V\sqrt{3}}{2}$, qua proſilire ſurſum poſſit aqua ad tres quartas partes altitudinis vaſis ſupra foramen, longe abeſt ab experimentis, quibus reperiuntur fontes ſalientes ad integram fere ciſternæ altitudinem adſurgere. Provenit autem iſtud velocitatis diſcrimen ex aëris ambientis reſiſtentia, quæ tantum abeſt ut minuat altitudinem ſalientium, quod vulgo creditur, eandem non parum auget, id quod ex *Problematis* ſeptimi ſolutione patebit.

## SCHOLIUM II.

Ex iis, quæ ſupra expoſuimus in *Scholio* 2. *Problematis* II. patet valores hoſce ipſarum $\varrho$ & $\upsilon$, pro accuratis haberi non poſſe, niſi altitudo aquæ pro infinita habeatur reſpectu diametri foraminis, proxime tamen ad veros valores accedere, ſi altitudo aquæ ſit diametri foraminis dupla, aut duplo major. Quod ſi eoſdem valores accurate velis determinare, adhibere poteris *Menſuram* eodem *Scholio* definitam, ſive $2mAr \times \frac{\overline{M+N-4Ar}}{\sqrt{L+K-\frac{3}{2}r^2}}$, unde habebis $\upsilon = \frac{rV}{2} \times \frac{\sqrt{L+K-\frac{3}{2}r^2}}{M+N-4Ar}$ & $\varrho = \sqrt{2} \times \frac{\overline{M+N-4Ar}}{\sqrt{L+K-\frac{3}{2}r^2}}$. Poteris etiam adhibere ſeries infinitas eodem *Scholio* expoſitas.

## PROBLEMA IV.

*Aqua in vacuum effluente ex foramine circulari in medio fundo vaſis cylindrici, ubi particulæ aquæ inter defluendum intra vas tantam patiuntur reſiſtentiam ex defectu lubricitatis, ut inde notabiliter imminuatur* Motus *aquæ, & data* Menſura *aquæ effluentis, definire* Motum *ejuſdem, & velocitatem qua per medium foramen egreditur.*

Sit data *Menſura* aquæ tempore $T$ effluentis, $2mr^2Aq$. Huic ergo æqualis erit *Menſuræ* per analyſin deſignata in ſolutione *Problematis* ſecundi, nempe $\frac{2mr^2Av}{3V}$, hoc eſt $2mr^2Aq = \frac{2mr^2Av}{3V}$, ſive $v = 3Vq$.

*Motus* vero ejuſdem aquæ per analyſin deſignatus in eodem *Problemate*, eſt $\frac{mr^2Av^2}{3V}$; & loco $v^2$ ſubſtituendo ejus valorem modo inventum, fit is *Motus* $\frac{mr^2A}{3V}\times 9V^2q^2 = 3q^2mr^2AV$. Q. E. I.

COROLL. Si ex *Motu*, qui tempore *T* generari poſſit a columna aquea foramini inſiſtente, ſive ex $mr^2AV$, detrahatur *Motus* aquæ eodem tempore effluentis, $3q^2mr^2AV$, relinquitur *Motus* tempore *T* ex reſiſtentia deperditus $mr^2AV\times\overline{1-3q^2}$.

### SCHOLIUM.

Si accuratam ſolutionem deſideres, recurrendum eſt ad Scholium ſecundum Probl. II. hunc in modum; $2mr^2Aq = \frac{16mA^2v}{rV}\times\overline{M+N-4Ar}$, unde $v = Vq\times\frac{r^3}{8A\times\overline{M+N-4Ar}}$. Et *Motus* aquæ effluentis tempore *T*, erit $mr^2AV\times q^2r^2\times\frac{\overline{L+K-\frac{3}{2}r^2}}{\overline{M+N-4Ar}|^2}$: unde *Motus* ex reſiſtentia deperditus tempore *T*, erit $mr^2AV\times\overline{1-\frac{q^2r^2\times\overline{L+K-\frac{3}{2}r^2}}{\overline{M+N-4Ar}|^2}}$.

## PPOBLEMA V.

*Iiſdem poſitis datiſque, & negligendo accelerationem aquæ extra foramen, determinare diametrum venæ aqueæ ad parvam diſtantiam extra foramen, ubi vena maxime contrahitur, & velocitatem aquæ in vena ſic contracta.*

Per tertium *Problema*, *Menſura* aquæ per ſectionem venæ tranſeuntis tempore $T$ eſt $\frac{2m\varrho^2 Av}{V}$: hæc autem æqualis eſt *Menſuræ* datæ $2mr^2Aq$; unde $\varrho^2 v = r^2 Vq$.

Porro, per idem *Problema* tertium, *Motus* aquæ per ſectionem venæ tranſeuntis tempore $T$, eſt $\frac{2m\varrho^2 Av^2}{V}$, cui æqualis eſt *Motus* ſuperiore problemate definitus, $3q^2mr^2AV$, unde $2\varrho^2v^2 = 3q^2r^2V^2$.

Eſt autem $v = \frac{2\varrho^2v^2}{2\varrho^2v} = \frac{3q^2r^2V^2}{2qr^2V} = \frac{3qV}{2}$.

Et $\varrho^2 = \frac{r^2Vq}{v} = r^2Vq \times \frac{2}{3qV} = \frac{2r^2}{3}$; unde $\varrho = \frac{r\sqrt{2}}{\sqrt{3}}$. Q.E.I.

COROLL. I. Eadem perſtat ratio inter radium foraminis & radium venæ contractæ, ſive minuatur utcunque per reſiſtentiam *Motus* aquæ effluentis, ut in hoc *Problemate*, ſive non minuatur, ut in *Problemate* III. cum ſit utrobique $\varrho = \frac{r\sqrt{2}}{\sqrt{3}}$.

COROLL. 2. Cum minuitur per reſiſtentiam *Motus* aquæ effluentis, minuitur ſimul velocitas in vena contracta. Cum enim in *Problemate* tertio fuerat $v = \frac{V\sqrt{3}}{2}$, ſit modo $v = \frac{3qV}{2}$, hoc eſt, minuitur $v$ ex $V \times 0{,}866$ ad $V \times 0{,}856$ ſumendo $q = 0{,}571$ ex *Poleni* experimentis.

### SCHOLIUM.

Accurate erit $v = V \times r^2 q \times \overline{\frac{L+K-\frac{3}{2}r^2}{M+N-4Ar}}|^2$, eritque $\varsigma = \sqrt{2} \times \frac{\overline{M+N-4Ar}}{\sqrt{L+K-\frac{3}{2}r^2}}$, pariter atque inventum eſt in *Scholio* ſecundo *Problematis* tertii.

### PROBLEMA VI.

*Aqua in aërem effluente per foramen circulare in medio fundo vaſis cylindrici, ubi particulæ aquæ inter defluendum intra vas tantam patiuntur reſiſtentiam ex defectu lubricitatis, ut inde notabiliter minuatur* Motus *aquæ, & data* Menſura *aquæ effluentis, definire* Motum *ejuſdem, & velocitatem qua per medium foramen egreditur.*

Sit data *Menſura* aquæ tempore $T$ effluentis $2mr^2Aq$, ut in *Problemate* IV. & ope ejuſdem *Problematis* habebitur *Motus* ejuſdem $3q^2mr^2AV$, & velocitas quacum egreditur per centrum foraminis, ſive $v = 3qV$. Q.E.I.

COROLL. Cum detur $q$, eſt $v$ ut $V$, hoc eſt, ut $\sqrt{A}$.

## SCHOLIUM.

Hæc eadem accurate definita reperies in *Scholio Problematis* IV.

## PROBLEMA VII.

*Aqua in aërem effluente, negligendo accelerationem aquæ extra foramen ex gravitate ortam, ſi dentur duæ quælibet ex tribus ſequentibus, nempe* Menſura *aquæ effluentis, velocitate in axe venæ contractæ, & diametro ejuſdem venæ, reliquam determinare.*

Cum aqua ex foramine erumpens per vacuum fertur, oſtenſum eſt in ſolutione *Problematis* III. æqualem fieri velocitatem particularum aquæ per totam ſectionem venæ contractæ: Nunc autem, cum vena per aërem fertur, tollitur neceſſario æqualitas iſta velocitatis. Partes enim venæ exteriores aërem circumjacentem in motum concitant, atque ab eodem ipſæ retardantur, adeo ut parem cum reliquis velocitatem adipiſci nequeant. Partes autem extimæ, cum ab aere retardentur, partes contiguas interiores retardant, hæque proximas; atque eo pacto fit, ut particula quæque interior celerius feratur particula contigua exteriore, adeo ut velocitas maxima ſit in axe venæ, in ambitu minima. Et cum partes exteriores tardius ferantur per aërem, quam, ſublato aëre, per vacuum ferrentur, inde fit ut partes mediæ velocius ferantur, aëre venam ambiente, quam ferrentur aëre ſublato. Qua de cauſa mediæ partes aquæ in fontibus ſalientibus multo altius adſurgunt in aëre aperto, quam in vacuo eſſent adſcenſuræ, prout monuimus ſub finem *Schol.* 1. *Probl.* III.

Porro, eæ partes aeris, quæ venæ aqueæ ſunt contiguæ, cum ab aqua in motum concitentur, ipſæ alias ſibi extrorſum adjacentes in motum concitant, hæque proximas exteriores, & illæ reliquas ſucceſſive ad certam aliquam diſtantiam ab ambitu venæ.

Velocitas autem particularum aquæ ab axe venæ ad ambitum ejuſdem ita decreſcat, neceſſe eſt, ut particulæ cujuſque ubicunque ſitæ una eademque ſit velocitas relativa reſpectu particulæ extrorſum adjacentis, iiſdem ex cauſis quas expoſuimus in ſolutione *Problematis* ſecundi. Nam ſi quævis particula velocitatem relativam majorem habeat quam reliquæ, ea majorem experietur reſiſtentiam ex attritu particulæ extrorſum adjacentis, & eo pacto ad æqualem cum ceteris velocitatem relativam perducetur. Pari modo particula quæque aeris circumpoſiti, qui in motum concitatur, unam eamdemque habebit velocitatem relativam reſpectu particulæ aëreæ extrorſum adjacentis.

At longe diſcrepat velocitas relativa particularum aquearum inter ſe, a velocitate relativa particularum aeris, quod hoc modo concipi poteſt.

Particula quævis aquæ in extima vena conſtituta, a particula aquæ introrſum proxima ſollicitatur ad motum accelerandum; eadem a particula proxima aeris retardatur: & cum particula iſta extima juſtam velocitatem adepta ſit, pares ſint, neceſſe eſt, hæ duæ vires contrariæ, quarum altera retardat particulam, altera accelerat. Id vero fieri non poteſt, niſi factum ex velocitate relativa & denſitate particulæ aqueæ accelerantis, æquale ſit facto ex velocitate relativa & denſitate particulæ aereæ retardantis. Eſt autem denſitas aeris ad denſitatem aquæ, ut 1 ad 900 circiter. Itaque velocitas relativa inter extimam particulam aqueam & proximam aeream, eſt ad velocitatem relativam inter duas proximas particulas aqueas, ut 900 ad 1 circiter.

Porro, particula iſta intima aerea ad motum accelerandum ſollicitatur a proxima contigua particula aquea, retardatur a particula aerea extrorſum proxima. Cumque hic etiam vires duæ contrariæ ſibi invicem æquales ſint, erit factum ex denſitate & velocitate relativa particulæ aqueæ accelerantis, æquale facto ex denſitate & velocitate relativa particulæ aereæ retardantis. Unde erit velocitas relativa, quæ eſt inter duas iſtas particulas aereas, ad velocitatem relativam, quæ eſt inter particulam intimam aeream & proximam aqueam, ut 900 ad 1 circiter; eritque eadem ad velocitatem relativam, quæ eſt inter duas proximas particulas aqueas, ut 900×900 ad 1 fere: & hæc tanta velocitas relativa perpetuo ſibi conſtabit per totam craſſitiem annuli aerei, qui ab aqua profluente in motum concitatur.

Deſignentur jam literis $r, m, v, a, V, A, T$, eadem atque in ſecundo Problemate literis iiſdem ſignificantur. Eſto etiam $\upsilon$ velocitas aquæ in axe venæ aqueæ contractæ, $\varrho$ radius ejuſdem venæ, $R$ radius venæ imaginariæ, per quem velocitas $\upsilon$, decreſcendo gradatim, pari modo atque decreſcit in vena vera, tandem ad nihilum redigatur.

Sit etiam *Menſura* aquæ tempore $T$ effluentis per foramen, $2qmr^2A$.

Jam *Menſura* aquæ eodem tempore fluentis per venam contractam, methodo in *Problemate* II. expoſita, invenietur $\frac{2mAv\varrho^2}{3RV} \times \overline{3R-2\varrho}$.

Hæ autem *Menſuræ* æquales ſunt, hoc eſt, $2qmr^2A = \frac{2mAv\varrho^2}{3RV} \times \overline{3R-2\varrho}$, ſive, $3qr^2RV = v\varrho^2 \times \overline{3R-2\varrho}$.

Porro, cum *Menſura* aquæ effluentis per foramen tempore $T$ ſit $2qmr^2A$, *Motus* ejuſdem, per *Problema* VI. eſt $3q^2mr^2AV$.

Et *Motus* aquæ per venam fluentis eodem tempore, per methodum *Problemate* ſecundo uſurpatam, invenitur $\frac{mAv^2 \times \overline{6R^2\varrho^2 - 8R\varrho^3 + 3\varrho^4}}{3VR^2}$.

Hi autem æquales ſunt, hoc eſt, $3q^2mr^2AV = \frac{mAv^2 \times \overline{6R^2\varrho^2 - 8R\varrho^3 + 3\varrho^4}}{3VR^2}$, ſive, $9q^2r^2R^2V^2 = v^2 \times \overline{6R^2\varrho^2 - 8R\varrho^3 + 3\varrho^4}$.

Duabus his æquationibus rite reductis ad expungendam $R$, pervenitur ad æquationem ſequentem, $\varrho^4v^2 = 2qvVr^2\varrho^2 + 12q^2V^2r^2\varrho^2 - 9q^2V^2r^4$, unde $\varrho^2 = \frac{qVr^2}{v^2} \times \overline{v + 6qV - 2\sqrt{3qvV + 9q^2V^2 - 2v^2}}$, & hinc obtinetur ipſe $\varrho$, ſive radius venæ contractæ, cum dantur $q$ & $v$.

Porro, ex eadem æquatione elicitur, $v = \frac{qVr}{\rho^2} \times \overline{r + 2\sqrt{3\rho^2 - 2r^2}}$.

Denique, $q = \frac{\rho^2 v}{rV \times \overline{r + 2\sqrt{3\rho^2 - 2r^2}}}$. Q.E.I.

### SCHOLIUM I.

Supra poſuimus *Motum* aquæ per venam contractam fluentis æqualem *Motui* effluentis per foramen. Id autem, ſi rigorem Mathematicum ſpectes, non eſt verum. *Motus* enim aquæ per foramen effluentis aqualis eſt *Motui* aquæ per venam contractam fluentis, & *Motui* annuli aerei venam ambientis, qui aer ab aqua per venam fluente in motum concitatur, ſimul ſumptis. Sed annuli aerei *Motum*, cum ejus annuli craſſities non ſit major quam $\frac{R - \rho}{900 \times 900}$, ejuſque denſitas non ſit major parte $\frac{1}{900}$ denſitatis aquæ, pro nihilo habemus; idque faciendo æquationes longe ſimpliciores reddimus quam alioqui eſſent futuræ.

### SCHOLIUM II.

Per *Corollarium* 1. *Problematis* V. cum aqua in vacuum effluit, eadem ſemper perſtat ratio inter radium foraminis & radium venæ contractæ, ſive minuatur utcunque per reſiſtentiam *Motus* aquæ effluentis, ſive non minuatur. Unde, ut in re phyſica, veri ſimillimum cenſemus, datam haberi rationem inter hos radios, etiam cum aqua per aerem profluit, utcunque minuatur *Motus* aquæ effluentis per reſiſtentiam, aut ſaltem eam rationem non niſi quam minimum mutari. Idque cum reperiatur conſentaneum experimentis hactenus factis, quod infra clarius apparebit, nos pro vero habebimus, donec experimenta in poſterum accuratius inſtituenda aliquid certius docuerint.

Porro, ſi datur ratio inter $r$ & $\varrho$, datur etiam ratio inter $r$ & $R$, ſive ratio inter radium foraminis, & radium imaginarium, per quem velocitas $v$ gradatim decreſcendo ad nihilum redigitur.

Nam, eliminando $v$ ex æquationibus duabus ſupra poſitis, $9q^2r^2R^2V^2 = \varrho^2v^2 \times \overline{6R^2 - 8R\varrho + 3\varrho^2}$, & $3qr^2RV = \varrho^2v \times \overline{3R - 2\varrho}$, pervenitur ad æquationem, $\varrho^2 \times \overline{9R^2 - 12R\varrho + 4\varrho^2} = r^2 \times \overline{6R^2 - 9R\varrho + 3\varrho^2}$, unde $R = \frac{\varrho}{3} \times \overline{2 + \frac{r}{\sqrt{3\varrho^2 - 2r^2}}}$.

Præterea, ex altera harum æquationum, $3qr^2RV = \varrho^2v \times \overline{3R - 2\varrho}$, fit $3r^2R : \varrho^2 \times \overline{3R - 2\varrho} :: v : qV$, & cum data ſit ratio prior, datur etiam ratio poſterior, hoc eſt, datur quantitas $\frac{v}{qV}$.

Quantæ autem ſint tres hæ rationes datæ, poſtea demonſtrabimus.

*Reliqua proximo Tranſactionum Numero communicabimus.*

# III. *Dias* Antrorum *mirabilis Naturæ*, glacialis *alterius*, *alterius* Halitus noxios *eructantis*, *ad* Regiam Societatem *Scientiarum* Londinenſem, *a* Matthia Belio *Pannonio*, *R. S. S. miſſa*.

## CAPUT I.

### *De* Antro *Glaciali* Szelicenſi.

§. I. EST, in *Carpathi* radicibus, qua ſe in meridiem, jugis dorſiſque ſenſim miteſcentibus, ſinuant, *Comitatus Thornenſis*, ab arce *Thorna*, ſic adpellatus. Anguſto is ambitu, ac fere montibus impedito, definitur: quos tamen, pro *Carpathi* ingenio, paſſim naturæ prodigia, inſignes faciunt. In his montem ſuo merito recenſueris, qui inter *Szelicze*, & *Borſua*, vicos adtollitur: non quod mole reliquos antecellat, ſed quod ſpeciem habeat portentoſam, cujus nunc hiſtoria exhibenda eſt.

§. II. *Antrum Szelicenſe* dicimus, a vico *Szelicze* nuncupatum. Situs pago, inter ſylvas ac nemora, collinus ideoque effœtus, cœlum aſperum, aër obtigit frigidus, quem validi ac fere perpetui Aquilones, ex nivoſo celſoque illo *Carpatho*, a Septentrione dejecti, extra modum immitem reddunt, ut muſcis atque culicibus tunc quoque inhoſpitalis ſit, cum tota regione maxime calet. In hujus vici agro, antrum, de quo ſermo eſt, in montem nunc memoratum grandi & obverſo in Aquilonem hiatu dehiſcit: quippe qui, orgyias XVIII. altus, IX. latus eſt, atque ideo accipiendis ac penitus hauriendis Aquilonibus ſic ſatis idoneus ncus laxuſque. Profunda antri, & ſubterranei petroſique ſpecus, inexpertis meatibus, in Meridiem abeunt.

§. III. Natura antri id habet prodigii, quod cum extus bruma intenſiſſime riget, tepido ſit intus aere; frigido contra, immo glaciali, cum ſunt fervidiſſimi ſoles. Nimirum, ſimul diffugientibus nivibus, ver inire cœpit, interior antri concameratio, qua ea meridiano ſoli dorſo objicit, aquam limpidam & paſſim diſtillantem exſudat: quæ interni frigoris vi, in pellucidam glaciem concreſcens, ſtirias efficit, ad ingentium doliorum molem craſſas ac pendulas, inque ramos abeuntes, miris illuſos ſpeciebus. Quod aquæ, e ſtiriis, humi arenoſæ decidit, id quoque opinione celerius congelat. Ergo, non fornices modo, natura in ſolidam petram cavati, ſed fundum quoque antri, multa & nitida glacie conveſtitum eſt. Crederes, totam cavernam, e cryſtallo, ſubſtructam incruſtatamque eſſe, ita circumquaque glacies reſplendeſcit.

§. IV. Inuſitatus hic obtutus eo eſt ingredientibus ſpecioſior, quo antri intercapedo & latius abit, & deprimitur profundius. Qua adiri poteſt antrum, quinquaginta orgyiarum profundum, ſex & viginti laxum eſt; concamerationum altitudine, ob tuberoſos rupium arcus, inæquali. Quod ultra demergitur, propter hiatus præcipitium, inexpertos habet receſſus. Neque enim erat adhuc, qui in adeundis antri penetralibus facere voluiſſet periculum, ob lubricos greſſus, & fallentem veſtigia glaciem. Certe enim, inciſis, multo labore, gradibus opus habent, qui vel exploratum profundum illud adire volunt. Erant, qui immiſſa bolide, ſpecus interiora ibant exploratum: verum, quod antrum, non ad putei modum recto tramite, ſeu perpendiculariter, deprimitur, ſed varie ſe, & in anfractus ſinuat, inutile fuit experimentum. Plus ii profecerunt, qui ſclopos, ſolide largeque fartos, intra ſpecum diſploſerunt. Adverſum eſt enim, abſorptos intime boatus, per plura temporis minuta, ad modum validiſſimi tonitru, illiſo huc & illuc ſonitu, horrendum quid reboaſſe: quod argumento fuit, profunde antrum propagari, habereque diffuſos quaquaverſum meatus.

§. V. Glaciale iſtud ſpecus ingenium, totum æſtivum eſt: quod ideo admirationis habet plurimum; augeſcit enim cum increſcente ſolis ardore. Primo, nimirum, vere, hibernus ille tepor ceſſare, mox, ubi id adolevit, intendi frigus occipit, tantis acceſſionibus, ut quo magis aër incaleſcit, eo antrum frigeat exquiſitius. At ubi æſtas iniit, jamque fervet Canicula, in glacialem brumam intus abeunt omnia. Tunc ſcilicet, ubertim deſtillantes ex ſpecus fornicibus aquæ, in glaciem ſolidantur, tantis incrementis, ut, qua hodie tenues adparebant ſtiriæ, eæ perendie dolia referant, & quaſi in præceps ruentia petrarum fragmenta. Paſſim, qua guttatim per antri latera, demanat latex, mirificæ viſuntur incruſtationes, & ad tapetum formam, quaſi ex artis præſcripto, fabrefactæ. Reliquum glaciei ita mutuo hæreſcit, prouti æſtus ſub dio ſunt viciſſitudines. Nam, ſi continenter & vehementius calcat, plus glaciei & ſtiriis adcreſcit, & parietibus fundoque antri; ſin calor, quod fit, aut Aquilonibus aut delapſis imbribus temperetur, lentius concreſcunt aquæ, quin & glacies ipſa largius tunc ſudat, & exiles quaſi rivulos quoſdam fundere incipit: dum, incaleſcente iterum cœlo, ad ingenium redeat, glaciale ſpecus temperamentum. Fuere, qui obſervârunt, præſagire ejus naturam aëris viciſſitudines, ſicuti ſolent barometra. Nam, ſi aër extus immineat fervidior, pluribus ante horis, quam fervor ille adeſt, tenaciore gelu aquæ adſtringuntur in glaciem: quod contra ſe habet, ſi aer ſub dio ingruat frigidior; tunc enim, calidiſſimo adhuc cœlo, dimanare ſenſim glacies incipit.

§. VI. Fit, ex hac antri natura, ut tantum ei ſufficiat, de pellucidiſſima glacie, quantum ne ſexcentæ quidem quadrigæ, in ſingulas hebdomadas oneratæ, poſſint exinanire. Atque habent hoc omnino in more poſitum accolæ, ut cum operis campeſtribus diſtinentur, & aut fœno parando, aut cogendis frugibus, in antri hac vicinia, ſuo ritu, vacant, glaciem hinc promant, eaque aut refrigerent tepentes fontanas, aut ad ſolis æſtum glaciem ipſam in potum liquefaciant: inſigni ſalubritatis opinione; quando putant aquæ iſtud genus & ſtomachum minus onerare, & pronius ſeu per ſudores excerni, ſeu per veſicam: quod proclive eſt omnino ad credendum, in ea aquarum percolatione: qua de re jamjam arguendi erit locus.

§. VII. Sunt vero frigori, intenſiori illi, & remiſſiori, ſuæ per antrum regiones. Ex aprico, jucundus ad ſpecum eſt aditus: quippe auram adflans, Etheſiarum ſimillimam. Mox, ad paſſus aliquot progreſſis, plus inhorreſcere, ac ſi porro pedem proferant, ſubeantque antri propylæon, artus intremiſcere occipiunt, ut neceſſum habeant laxatas forte ſub dio veſtes curatius adſtringere. Inde, in profundum abeuntes frigus excipit brumali ſuppar, ut hi quidem calidiore halitu manus confovere, illi valida artuum commotione, moleſtum, ac fere intolerabile frigus, mitigare debeant.

Quod eo ſubinde ſit intenſius, quo ſe profundius immittunt curioſi ſcrutatores. Sed, gradum referentibus, contraria eveniunt omnia: nam, quo ex imo, pedem efferunt altius, eo frigus eſt remiſſius; dum remittat atque intepeſcat penitus. Poſtea, ubi Canicula deferbuit, jamque in autumnum æſtas deſiit externi aëris habitum ſpecus ſuapte natura ſequitur. Primis nimirum menſibus, & dum noctes ineunt gelidiores, dimanare ſenſim glacies, tunc frigeſcente magis ac magis aëre, & ubi jam glacie extus rivi adſtringuntur, quaſi admotis ignibus, liqueſcere incipit; donec incumbente bruma, nullo poſt ſe relicto veſtigio, prorſus inareſcat. Tunc vero placidus, toti ſpecui, calor inducitur, fitque glaciale illud conditorium perfugio inſectis, & beſtiolis aliis hiemem ægre ferentibus. Nam præter muſcarum & culicum agmina, veſpertilionum item globos, atque noctuarum contubernia, lepores quoque & vulpes hoſpitatum huc concedunt: dum adoleſcente vere iterum redeat ſpecui glaciale illud ingenium. Antri ſuperficies, profunda humo obruta, atque ſoli oppoſita meridiano, ubere ac pingui gramine herbeſcit, eſtque ideo pabulantibus armentis, quin & fœniſcoio, ſi pecus arceatur, opportuna.

§. VIII. Hæc ita ſe habent. Nunc, quemadmodum inſolens antri natura explicanda ſit, paucis videamus. Univerſim, eæ ſunt caloris atque frigoris viciſſitudines, in ſubterraneis, ut certare quaſi mutuo videantur. Nam, cum æſtuat foris aer, frigent cavernarum iſtiuſmodi receſſus; atque tepent iterum, cum extus aëre frigus eſt: id quod, cellæ vinariæ, profundius paulo depreſſæ, quotidiano & vulgari ſatis experimento, condocent. Nempe, ea eſt caloris efficacitas, ut, quum telluri, elemento ex ſe craſſo, humido, ac ſrigido, incumbit, nativum ejus frigus interius propulſet, atque in factas arte aut natura ſpecus, coactum, notabiliter condenſet. Quod aliter ſe habet, quando frigus terræ ſuperficiei incubat; prolicit enim, imis viſceribus, conceptum, a quocunque principio, calorem, & qua ſe per cellas aut cavernas diffundere poteſt, aërem efficit tepidum, paſſim etiam eximie calentem. Succurrit, hæc ſcribenti, civium meorum, per Hungariam, campeſtrem illam, & æſtivis ſolibus, extra modum torridam. vini frigefaciendi, vetus conſuetudo. Nempe, cum per vaſtas ſolitudines iter faciunt, aut illic, pro re nata, moras coguntur nectere, neque aut glacies, aut fontana aqua, refrigerando potui ſufficit, ſcrobem, ad duorum fere pedum altitudinem, humi defodiunt: huc demum vinarias lagenas immittunt, atque refoſſa humo, diligenter ac ſolide contegunt: tunc ignem ſubitaneum & luculentum, ſuper eadem illa ſcrobe, in qua vinum eſt conditum, ex ſtramine, fœno aut arundine, componunt; qui ubi ſuapte reſtinctus, aut disjectus eſt conſulto, regeſta calente extus humo, vinum eximunt, non ſecus refrigeratum, quam ſi aquæ glaciali immerſum habuiſſent. Unde vero, vino illi inductum frigus illud? Nimirum, flammarum ille fervor, qui ſuperficiem ſcrobis ſubito concaleſecit, nativum terræ frigus, undiquaque condenſatum, lagenæ circumfudit, quod demum vinum pervaſit, fecitque guſtui idoneum.

§. IX. Pronum hinc eſt conjicere, quemadmodum antrum iſtud *Szelizenſe*, nunc glaciali ſit natura, nunc iterum tepeſcente. Caloris extus, in antri ſuperficiem incumbentis, vis & efficacitas, condenſato, terræ atque petrarum, quæ ſubtus in fornices abeunt, nativo frigore, aquas gelidas primum, mox & congelantes,

lantes, efficit: dum refrigerato iterum aëre, proliciatur, imis terræ viſceribus conceptus calor. Hæc, ad eum modum, vulgo in ſenſus incurrunt. Quæ cum adſero, non ideo accedo *Morini* ſententiæ, qua apud *du Hamelium*, terram, uti aërem, in tres diſpertitur regiones; quarum prima, alternis friget & calet; hieme calida, æſtate frigidior, uſque ad cccc hexapedas ſeu orgyias patet. Hanc ſecunda regio, ejuſdem illa opinione, excipit, quam ſemper fervere, ipſe expertum ſe in fodinis Hungaricis ait. Tertiam, jugi frigore tanquam centro terræ, proximam algere conjectat; quemadmodum media aëris regio perpetuo frigida eſt, ac ſuprema, & cœlo finitima, ſemper calet. Hæc, inquam, *Morino* relinquimus, tanquam inexplorata incertaque. Sane, quæ de fodinis Hungaricis, ad regionis ſecundæ perpetuum calorem adſerendum, memorat, non ſunt undiquaque vero conſentanea. Nam fodinarum quidem, quas optime cognitas habeo, nulla ad quadringentarum orgyiarum profundum, vix ulla ad ducentas hexapedas, deprimitur, ob erumpentium ſubtus aquarum impedimenta; qui ergo poterat ferventem perpetuo regionem terræ ſecundam, demum infra quadringentas hexapedas, ineuntem, adire? Sunt fodinis ſuæ omnino regiones, tepidæ hic, ferventes alibi, etiam iis locis, quorum profundum ne octoginta quidem orgyias conficit. Sed, ad antri glacialem naturam redeamus.

§. X. Multum, ad eam confert, præter vulgarem, quam adtulimus, cauſſam illam, ab incumbentis caloris vi petitam, ipſa antri poſitio, & concamerationis ingenium. Obverſum eſt nempe ore hiante, frigidiſſimis Aquilonibus, qui a *Scepuſiaco Carpatho*, in has ejus radices immiſſi, & frequentes ſunt, & vernis potiſſimum atque æſtivis menſibus, ultra modum ſæviunt, immo furunt; quodque ex nivoſis montibus illis deruunt, vehunt ſecum gelidiſſimas particulas, quæ demum in os antri illapſæ, & in ejus concavo, quaſi conglomeratæ urgente extus calore, ex facili, deſtillantem aquam pervadunt, inque glaciem adſtringunt. Accedit, habitus concamerationum, quæ totæ e petris, ſolidiſſime invicem compactis, & heic ſubmotis altius, alibi in ruinam quaſi impendentibus, factæ ſunt. Petrarum autem *Carpathi*, plerumque, ſalſa, nitroſa, aluminoſa atque vitriolica eſt natura. Ergo quid eſſe poteſt proclivius, quam glaciem in antro hoc *Szelicenſi*, ex glacialium & dictarum particularum commixtione, ubertim progenerari? Adſentientur nobis, qui artificioſam liquorum congelationem, repetitis ſæpius experimentis, condidicerunt. Nix enim, vel glacies, cum, ſale communi, nitro, aut alumine, aut vitriolo, æqua portione, permixta, & vaſi circumpoſita, aquam vaſe contentam, in glaciem congelat, etiam media æſtate, vel prope ad ignem: ut documenta alia, quæ ſunt in promptu, ſileamus. Hucuſque de antro *Szelicenſi*.

## CAPUT II.

### *De* Antro Ribarienſi, *Halitus noxios eructante*.

§. I. LEtales ſpecus, paſſim, per orbem terrarum obſervârunt veteres, juxta & nuperi ſcriptores. Non eſt inſtituti mei, eorum, vel nomina tantum conſectari: fuſe, id genus ſcrobes ſeu antra, & horum halitus, *Georgius Agricola* proſequitur, Libro IV. de Natura eorum, quæ effluunt e terra.

Domeſticum Hungariæ antrum, quod eſt in *Comitatu Zolienſi*, ad vicum *Ribar*, deſcribendum mihi propoſui: partim, ut rem omnem ex vero expromerem, partim ut ſcriptorum detegerem aberrationes. Meminet, antri hujus, laudatus nunc *Agricola*, eodem, quem citavi, loco: *Nec pars Ungariæ*, inquit, *quondam Dacia dicta, libera eſt a peſtilentibus ſpiraculis: quæ a* Neuſohla, *oppido, æris metallis claro, abſunt circiter ſex millia paſſuum, hæc interdum aves, quæ advolârint, & reliquas animantes, quæ acceſſerint, ſolent necare.* Male, *Neoſolium*, Dacia concludi, ſuo loco [a] monui; de peſtilentibus ſpiraculis, quæ accuſat *Agricola*, infra diſpiciam. Ad eum fere modum, *Wernherus*, ejuſdem *Ribarenſis* antri meminit [b], quem jam non eſt opus exſcribere: quippe qui, propoſitum habeam, meas ipſius ἀυτόπτȣ obſervationes, paucis recenſere.

§. II. *Ribar* vicus eſt *Comitatus Zolienſis*, ſeſquimilliari, ſecundo amne *Grano*, Neoſolio, in meridiem repreſſus: quem loco [c] nunc citato, memoravimus. In hujus agro, collina in orientem poſitione, *Thermæ* ſcatent, exquiſitæ quidem ſalubritatis; ſed ingenii admirabilis: quas jam non vacat expromere. A thermarum iſtis ſcatebris, ſexcentis circiter paſſibus, ad ſolem meridianum, ſpecus hæc, obnoxios, quos eructat, halitus, jam pridem infamis, in lætæ valliculæ, exiguo quodam, ſed graminoſo prato, ſe adaperit, habetque vicinum fontem acidum, ad potandum, ſic

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[a] Notitiæ Hung. Novæ Tomo II. in Hiſtoria Comitatus Zolienſis, Parte Gen. Memb. I. §. XII. p. 396.

[b] De Admirandis Hung. Aquis; & hunc ſequuti, innumeri alii.

[c] Tomo II. p. 504. num. 22.

ſatis idoneum. Olim, dum incurioſior iſtiuſmodi portentorum ætas fuit, vix erat quiſquam, qui animum advertiſſet, ad ſcrobis inuſitatæ ingenium. Ergo, ſibi quaſi relicta, & dumis circumdata, raro, aut nunquam adibatur. Fuit vero tunc, ad fontis modum, aquas ubertim eructantis, comparata, quæ, altius ſalientes non ſecus, circumquaque dimanabant, quam id in ſilanis fieri advertas, ubi aqua ex fuſore, in cadum ſaliens, iterum defluit, dum meatus arte factos, ſubeat. Aquæ indoles, lapideſcens fuit: quippe longo adfluxu, tophum generans, in eam ſenſim molem, circa os fontis excreſcentem, ut collis poſtea ſpeciem retulerit: quo quidem, tophacei lapidis incremento, ipſa demum ſcaturigo, adobruta eſt; quando nequibat latex ad ſumma fontis labra, ſicuti fiebat antea, bulliendo proſilire. Acceſſit, ruſticorum, fontis præſocandi ſtudium, ne eſſet, quod jumentis ſuis metuerent poſtea.

§. III. Hic vetus ſcrobis an fontis habitus fuit, cujus veſtigium, adparet hodieque, in meridionale prati latus, ad ſilvoſi collis pedem, reductum. Poſtea, cum ſubterraneæ atque uberes aquarum venæ, occultis meatibus, e nupero eo fonte, dimanarent, factum eſt, ut reſolutam humum, proxime ad priſtinam illam ſcaturiginem, ſubruerent, atque dehiſcente prato, novum hiatum aperirent. Hic demum, noxios illos halitus eructare iterum, & cum avibus, tum alii animantium generi, exitialis eſſe cœpit. Advertere agreſtes accolæ, non cavernam tantum, fatiſcente humo, loco antehac continenti, recenter factum, ſed perniciabiles etiam ejus exſpirationes; quando, nunc aves enectas, nunc proſtratas feras, ultimo, paſcentia iſthic jumenta, ſubito exanimata, reperiebant.

Dici nequit, quantis exſecrationibus inviſam ſpecum, ruſtica plebs, inſectata ſit: tamquam, quæ ab irato numine, depreſſa, toti illi agro perniciem, ſibi exitium, aut jamjam minaretur, aut portenderet in poſterum. Oſtenti fama late didita, Avernum hi, Orcum illi, alii, hiatum M. Curtii facinore, expiandum, conclamabant. Dehiſcebat vero caverna, ad infundibuli ſpeciem, cujus ſuprema circum labra, ad calicis modum, laxe & in longum diducta, (erant enim viginti quatuor paſſuum longa, lata duodecim) in arctum ſenſim coibant, dum in anguſtum foramen, imo fundo, deſinerent, per quod noxius ille halitus erumperet. Aquarum certe ſubterlabentium ſtreperum murmur exauditur adhuc, ut pronum ſit conjectatu, undoſum eſſe oportere rivum, qui per cœcos iſtos meatus fertur, hauriturque demum incertis gurgitibus. Neque enim uſquam erumpit in apricum, tametſi, prona, in vallem declivitas, modico a ſcrobe intervallo, ineat.

§. IV. Inſolens hoc cavernæ ingenium, uti penitus indagarem, non unam, inde ab Anno MDCCVIII. viam inii. Et primo quidem, cum amico, naturæ curioſo, pullum gallinaceum, bene adultum, haſtili alligatum, ſupra os ſpecus ita protendi, ut ferire eum debuerint erumpentes ex imo halitus. Vix vero, haſtile, ad ſpecum, cum pullo admoveram, cum miſer ille, alas complodere cœpit, momentoque exſpiravit. Secuimus enectum ita pullum, ut obſervaremus quid virulentæ rei fuerit, quod eum tam ſubito exanimârit? Sed nihil quidquam deprehendimus, quam reſtagnantem in præcordiis ſanguinem, ceteroquin ab omni labe alia intemeratum. Tunc, ipſus ego, exſectis prius in humo gradibus, in ſcrobem me immiſi, ut micantem intus aquam propius contemplarer; ſed ante pes erat referendus, quam penitius deſcendiſſem : eo quod, ex halituum adflatu, & pectus præfocari cœpit, & caput tentari vertigine. Illud mirabile viſum eſt, quod vapores cavernæ, & cum maxime noxii ſunt adverſi, nihil nebuloſi aut craſſi, quodque notabiliter in oculos incurriſſet, referrent : purus ei ſemper & limpidus aër incubat : quod aliter ſe habuit in Plutoneo, cujus Strabo atque Plinius meminere. Ergo experiundum rebamur, quid hoc ſit exſpirationum, quod, cum oculis notari haud poſſit, citam adeo mortem animantibus acceleret. Succurrebat, vix re alia naturam earum explorari poſſe, quam longiori & capaci fiſtula, ſclopum vocant, pyrio infarta pulvere, intra ſpecus intima, diſploſa. Id ut factum eſt, intonuit caverna, & quaſi fremitu edito, conceptum interne fumum, pluribus poſtea horis, jucundo ſpectaculo, eructabat. Cepimus proinde, ex hoc phænomeno, argumentum, immiſſas, diſploſione illa, in antrum, flammas, ſulphuroſas intus exhalationes, incendiſſe, quæ huc & illuc rotatæ, diutius poſtea in auras exſpirabant. Atque fuerunt ſane fœtoris eximie ſulphuroſi, prorſus ad eum modum, qualis tempeſtate ingruente, in thermis obſervatus a me eſt : qua de re infra.

§. V. Sulphureo iſto halitu obſervato, facile fuit ad exiſtimandum, quidquid perniciabilis noxæ ineſt, exſpirationibus illis, ſulphuri id adtribui oportere, volatili ei, & ultra omnem modum ſubtili. Itaque, dedimus operam, ut hauſtas ex caverna letifera aquas, firmando experimento, poſſemus ſollicitius adhibere. Incendit eam cupiditatem, avicularum enectarum, & paſſim circa ſpecum jacentium frequentia : vix enim unquam, ſeu mane, ſeu a prandiis, ad orcum hunc accedebamus, quin nova reperiremus funera. Inprimis, Erinaceus, nos adtentos fecit, qui eodem cacoëthe ſuffocatus, unius noctis intervallo, adeo intumuit, ut diſtenta cute, ſpinæ ſimul, firmiſſime alioquin hæreſcentes, radicitus eliſæ conſpicerentur: quod quidem ſuſpicandi locum præbuit, annon forte beſtiola, non halitus tantum cavernæ imbiberit, ſed & aquas ipſas, quæ interne magno niſu ebulliunt, & eodem iterum hiatu, ceu gurgite quodam, abſorbentur denuo. Pulmones certe erinacei, livido colore tincti, quin & viſcera reliqua, ultra ſolitam molem diſtenta, indicio fuerunt, & laticem guſtâſſe, & halitus noxios penitus bibiſſe beſtiam, jam tum, grave quid ac moleſtum, redolentem. Proinde, aquam, ex profundo eo cavernæ gurgite haurimus; haud, ſine famuli, quem pronum in caput, ſed funibus religatum, immiſeramus, periculo. Fuit ea limpiditate pluſquam cryſtallina, levis adhæc, & quaſi ætherea, odoris modice ſulphuroſi, ſaporis acidiuſculi quidem & modice acris, ſed haud tamen, ſeu linguam, ſeu palatum adrodentis. Nempe, ad ingenium acidularum, quas vicinas habet caverna, proxime ſunt viſæ accedere. Timidius primum, laticem ſuſpectum, & extremis tantum labris guſtabamus, dum, alter alterius exemplo factus audentior, modicos primum hauſtus, mox largiores etiam, nihil dubitaremus facere. Neque cuiquam, tametſi plerique noſtrum, delicatioris, & ex thermarum uſu, etiam faſtidioſi fuerint ventriculi, noxia fuit ea curioſitas; quin erant, qui aqua ea, vinum Hungaricum, generoſum illud, miſcere poſſe optarent.

§. VI. Iſta ſic, & ex vero, plurium annorum curis adhibitis obſervavimus; ut ferri hinc poſſit judicium, rectene, ab *Agricola*, & *Wernhero*, peſtilentes ſpecus hujatis exſpirationes, adpellentur. Nuperus ſcriptor, virus omne, vel a terræ putredine, vel a ſtagnantis neſcio cujus humoris, vitioſitate, provenire, audaciter exiſtimat: quas opiniones ſingulas, jam excutiamus. Et primo quidem, tametſi letales ſint cavernæ hujus halitus, peſtilentes certe non ſunt: quippe qui, non ob congenitum, & quod ſecum veherent, virus enecant animantia; ſed ex cauſis aliis, quas mox indicabimus. Enimvero, ſi peſtilentiales eſſent exſpirationes illæ, aquæ bibi, multo minus, enecta halitibus iſtis animalcula, uti ſunt galli gallinacei, turdi, palumbes, ac lepuſculi comedi, ſine vitæ, ſaltem melioris valetudinis jactura, poſſent: quod faciunt tamen procul omni noxa, qui rei inuſitatæ faciunt experimentum, dum in thermis hujatibus, aut animi aut ſalubritatis cauſſa, lavant. Sed terræ forte putredo, aut ſtagnantis cujuſcunque humoris vitium, exitiales illos ructus exſpirant. At horum profecto neutrum eſt. Nam, ſi hoc admittas; halitus cavernæ craſſos, atque nebuloſos; aquam contra turbidam & moleſtum quiddam ſapientem eſſe oportebit: quam tamen limpidam, ſaporis adhæc, non putridi, ſed ſubacidi; vapores præterea, ita comparatos eſſe diximus, ut oculis cerni obſervarique haud poſſint. Ergo a ſubtiliſſimi copia ſulphuris, & mineralium admixtis halitibus, qui per ſubterraneos eos meatus, una cum aquis, præcipiti ac ſtrepero lapſu feruntur, exſpirationum earum letalis noxietas arceſſi debet: non quod ſuapte natura ſint exitiales; ſed quod nimia illa ſubtilitas, completis ſubito pulmonum bronchiis, præcluſoque neceſſario ad reſpirandum aëre, adeoque præſocato illic ſanguine, ictu oculi, & ante enecent animantia, quam id exiſtimari poteſt. Qui aliter de re tota ſentiunt, & ipſi errant, & in errorem inducunt alios; cavernæ autem infamiam conflant, nulla alia ratione expungendam, quam ſi hac noſtra obſervatione, ad erroris confeſſionem, inducti, palinodiam cecinerint.

§. VII. Ceteroquin, de ſulphuroſo iſthoc exſpirationum cavernæ noſtræ ingenio, & inde capi poteſt indicium, quod thermæ adſitæ, ejuſdem ſint naturæ; tametſi craſſiorum halituum, & qui, nunc ſunt intenſiores, nunc remiſſiores iterum: quemadmodum ſcilicet, cœli aërîſque habitus eſt, quo in calidas illas, ſingularis prorſus eſſe conſuevit influxus. Nempe, ſi fervente aëre, in tempeſtatem pronum ſit cœlum, thermæ nunquam non ſulphur redolentes, ultra omnem modum ſulphuroſum quid fœtere incipiunt, fiuntque lavantibus non moleſtæ tantum, ſed etiam intolerabiles, immo letales; tunc maxime, cum, aquis per emiſſarium ex lavacro ſubductis, recentes iterum ebulliunt. Vidi equidem, virum robuſtum ac militarem ætate adhuc firma, cum ingruente, horis poſtmeridianis, graviore tempeſtate, in thermas lavaturus ſe immiſiſſet, ſuſtinuiſſetque aliquantiſper ſulphuroſos, qui tunc ex more invaluerunt, halitus, lymphato ſimilem, ex lavacro proſiliiſſe, conceptaque inde febri acuta, quatriduo poſt, mortem ſuam obiiſſe. Neſcio autem, etiamnc, tempeſtatum his viciſſitudinibus caverna, de qua agimus, ſit obnoxia: neque enim, quod dolendum, ita fui curioſus, ut & hoc momentum, reliquis experimentis, curatius, ſicuti meruit, adjunxiſſem. Illud conſtat, cœlo etiam ſudo, & cum nulla in aëre eſt tempeſtatis ſuſpicio, variare halituum noxiam efficacitatem illam; & nunc celerius enecare admota animalcula, nunc iterum lentius: quandoque ceſſare penitus, & quaſi ingenium ſuum deſerere: in

cujus tamen rei cauſſas, neque ipſus ego indagavi, neque memini, amicos unquam indagaviſſe. Jam, ita ſarmentis cavernam obruerunt accolæ, ut vix adiri poſſit amplius. Quin & avicularum funera rariora ſunt hodie, quam fuerant olim: quod equidem profundius, quam antea, manantibus aquis adtribuerim. Hæc de his, hactenus.

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## IV. *An Account of a very extraordinary* Tumour *in the Knee of a Perſon, whoſe Leg was taken off by Mr.* Jer. Peirce, *Surgeon at* Bath; *communicated in a Letter to Dr.* Mead, *Phyſician to His* MAJESTY, *and Fellow of the* College of Phyſicians, *and of the* Royal Society, London.

*SIR,* *Bath, June* 11. 1737.

AS no one has been more converſant with the ſurpriſing Diſorders to which Men are liable, or takes a greater Pleaſure in their Relief, than yourſelf, ſo I flatter myſelf the following Caſe cannot fail of being acceptable to you.

*William Hedges* of *Stratton* in *Somerſetſhire*, a Farmer's Son, of 25 Years of Age, of a muſcular healthy Habit, having never known any kind of Diſeaſe; about eight Years ſince firſt obſerved a ſmall Swelling on his Right Leg near the ſuperior Epiphyſis of the *Tibia*, which (to uſe his own Terms) he called a Splint, about the Bigneſs of a ſplit Horſe-bean. As he was not conſcious of any Bruiſe on the Part, and as it was wholly free from Pain, ſo the only Reaſon he had to regard it, was from its conſtant Increaſe, which during the two firſt Years was very ſlow; but afterwards it increas'd ſo faſt (though without Pain) as to render him altogether incapable of Labour from the time of Hay-Harveſt 1735.——

Upon taking off the Limb in *May* laſt, I found it weighed, with the Leg and Foot, Sixty-nine Pounds, which (to the beſt of my Remembrance) is Twenty-ſeven more than the Leg ſome Years ſince taken off at St. *Bartholomew*'s Hoſpital by Mr. *Gay*, for the like Diſorder. The Operation itſelf afforded nothing uncommon, except the Quantity of recurrent Blood, which, however greater than uſual, ſeemed proportional to the increaſed Bulk of the Part.

Upon examining this ſurpriſing Tumour, the adjacent Muſcles were found deſtitute of their fibrous and fleſhy Appearance (probably from the Preſſure, and great Extenſion, which they had ſuffer'd, and the little Motion which for ſome Years they had imploy'd upon the *Tarſus* and Toes); but the *Faſcia* and common Membranes of the Muſcles, being greatly thickened and callous, adhered to the ſubjacent Tumour; and upon removing this callous Integument, the Tumour appear'd cover'd with great Quantities of Blood-veſſels, much diſtended, and of a Colour more intenſely red than natural.——

The Tumour itſelf was Cartilaginous for the Space of half an Inch from its external Surface; from whence it form'd numberleſs bony Subſtances of various Forms, Colours, and Conſiſtences, which (growing more and more numerous, as they lay deeper) at laſt form'd a continual Subſtance completely oſſify'd: In the Centre of this bony Subſtance we found about a Quart of mucilaginous Liquor, no ways fetid, (though it was then ten Days from the Operation) whoſe Colour and Conſiſtence nearly reſembled that of *Linſeed Oil*; in which we obſerv'd many little bony Subſtances looſe and floating, ſimilar to many others adhering to the internal Surface of the Cavity, all which had nearly the Appearance of thoſe irregular Incruſtations, which in hollow Rocks are ſometimes made by the dropping of petrifying Waters. After the Operation, every Circumſtance of the Cure proceeded as I could wiſh, and the Stump is now healed.

It ſeems well worth obſerving, that the Parts above the Tumóur were very little alter'd from their natural State. The Cartilaginous Extremity of the *Femur* was perfectly ſmooth; nor had the *Rotula* ſuffer'd any other Injury except the Oſſification of the Ligament by which it is fixed to the *Tibia*; but the ſuperior Extremity of the *Fibula* was wholly loſt in the Tumour.

May we not juſtly admire the Goodneſs of a Conſtitution, which could bear ſuch enormous Extenſions in the Integuments, the Tendinous *Faſcia*, and even the Bone itſelf, without Pain and Inflammation? Or can we ſufficiently wonder, that the Fluids ſhould be ſo little diſpoſed to putrify, as to bear ſo great a Diminution in their Motion, and for ſo long Time, without vitiating the Conſtitution, or tainting even the Parts affected? Herewith (Sir) I beg your Acceptance of two Portraits of this ſurpriſing Caſe (See TAB. II.): The firſt Figure repreſents the Limb immediately after the Operation; the 2d Figure ſhews the Tumour as opened: In both the Artiſt has ſo far imployed his Care and Skill, as well in preſerving the juſt Dimenſions as in the Colours and Appearances, that I am left only to wiſh, that in the Deſcription, which I have made, my Pen had not fallen ſhort of his Pencil.——I am, with the greateſt Reſpect,

*SIR,*

*Your moſt obliged*
*humble Servant,*

Jer. Peirce.

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## V. *An Experiment concerning the* Spirit of Coals, *being part of a Letter to the Hon.* Rob. Boyle, *Eſq; from the late Rev.* John Clayton, *D. D. communicated by the Right Rev. Father in God* Robert *Lord Biſhop of* Corke *to the Right Hon.* John *Earl of* Egmont, *F. R. S.*

——HAving ſeen a Ditch within two Miles from *Wigan* in *Lancaſhire*, wherein the Water would ſeemingly burn like Brandy, the Flame of which was ſo fierce, that ſeveral Strangers have boiled Eggs over it; the People thereabouts indeed affirm, that about 30 Years ago it would have boiled a Piece of Beef; and that whereas much Rain formerly made it burn much fiercer, now after Rain it would ſcarce burn at all. It was after a long-continued Seaſon of Rain that I came to ſee the Place, and make ſome Experiments, and found accordingly, that a lighted Paper, though it were waved all over the Ditch, the Water would not take Fire. I then hired a Perſon to make a Dam in the Ditch, and fling out the Water, in order to try whether the Steam which aroſe from the Ditch would then take Fire, but found it would not. I ſtill, however, purſued my Experiment, and made him dig deeper; and when he had dug about the Depth of half a Yard, we found a ſhelly Coal, and the Candle being then put down into the Hole, the Air catched Fire, and continued burning.

I obſerved that there had formerly been Coal-pits in the ſame Cloſe of Ground; and I then got ſome Coal from one of the Pits neareſt thereunto, which I diſtilled in a Retort in an open Fire. At firſt there came over only *Phlegm*, afterwards a black *Oil*, and then likewiſe a *Spirit* aroſe, which I could noways condenſe, but it forced my Lute, or broke my Glaſſes. Once, when it had forced the Lute, coming cloſe thereto, in order to try to repair it, I obſerved that the Spirit which iſſued out caught Fire at the Flame of the Candle, and continued burning with Violence as it iſſued out, in a Stream, which I blew out, and lighted again, alternately, for ſeveral times. I then had a Mind to try if I could ſave any of this Spirit, in order to which I took a turbinated Receiver, and putting a Candle to the Pipe of the Receiver whilſt the Spirit aroſe, I obſerved that it catched Flame, and continued burning at the End of the Pipe, though you could not diſcern what fed the Flame: I then blew it out, and lighted it again ſeveral times; after which I fixed a Bladder, ſqueezed and void of Air, to the Pipe of the Receiver. The *Oil* and *Phlegm* deſcended into the Receiver, but the Spirit, ſtill aſcending, blew up the Bladder. I then filled a good many Bladders therewith, and might have filled an inconceiveable Number more; for the Spirit continued to riſe for ſeveral Hours, and filled the Bladders almoſt as faſt as a Man could have blown them with his Mouth; and yet the Quantity of Coals I diſtilled were inconſiderable.

I kept this Spirit in the Bladders a conſiderable time, and endeavour'd ſeveral ways to condenſe it, but in vain. And when I had a Mind to divert Strangers or Friends, I have frequently taken one of theſe Bladders, and pricking a Hole therein with a Pin, and compreſſing gently the Bladder near the Flame of a Candle till it once took Fire, it would then continue flaming till all the Spirit was compreſſed out of the Bladder; which was the more ſurpriſing, becauſe no one could diſcern any Difference in the Appearance between theſe Bladders and thoſe which are filled with common Air.

But then I found, that this Spirit muſt be kept in good thick Bladders, as in thoſe of an Ox, or the like; for if I filled Calves Bladders therewith, it would loſe its Inflammability in 24 Hours, though the Bladder became not relax at all.

## VI. *An Experiment concerning the* nitrous Particles *in the* Air; *by the ſame Hand.*

I Took a ſmall Gally-pot, ſuch as the Apothecaries in the North of *England* make uſe of, where I was when I made this Experiment, and ground the Top of it very ſmooth and true, and adapted thereto a Cover of blue Slate, which I had likewiſe ground with much Care. Into this Gally-pot I put equal Quantities of Nitre and Flour of Sulphur, about a Drachm of each. I then fixed on the Cover, putting it into a new Digeſter; but the Height which I raiſed the Heat to, and how long I continued it, I do not exactly remember, but believe it was three or four Seconds. When I opened it the Day following, I perceived ſomething had tranſpired betwixt the Top of the Gally-pot and the Cover; the top Edges of the Gally-pot, where the Glazing was ground off, being diſcolour'd, though the Nitre and Sulphur were very little diminiſhed as to their Weight; only they were melted into one Lump, which I took out of the Gally-pot.

And having ſet the empty Gally-pot upon a Shelf, upon looking at it the next Day, I found long hoary Hairs, very bright and brittle, all around the ground Edges of the Pot, very ſpecious to behold. After I had admired them a while, I gathered them, and, taſting them, found them to be pure Nitre. I then ſet the Pot upon the Shelf again, and in three or four Days, ſtill finding there were freſh Shoots made, as large and ſpecious as at the firſt, I gathered them a ſecond and third time; ſo that I ſuppoſe the

Pot would have continued to have ſhot freſh Nitre much longer, if I had not had urgent Uſe for it, to make other Experiments in. However, it is to be obſerved, that I had already gathered more Nitre than I put into the Pot at firſt; though, as I ſaid before, for what I could perceive, I had taken all or near all the Nitre that I firſt put in together with the Sulphur, out of the Pot in a Lump. Hence we may have ſome Conceptions of the Nature of mineral Earths, and how they grow and increaſe, when once impregnated with the Seeds of a Mineral. This likewiſe is a Proof of the Quantity of nitrous Particles with which the Air abounds, ſince the large Quantity of Nitre which I collected out of the Pot, when left empty upon the Shelf, could be ſupplied by the Air only.

*N. B.* Theſe three Experiments are all that I could ſave intire out of a great Number which were ſent to the Hon. Mr. *Boyle*, in Anſwer to a Letter from him to Mr. *John Clayton*, containing 17 *Quære's*.

ROBERT CORKE.

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## VII. *Extract of a Letter from* John Rutty, *M. D. to Dr.* Mortimer, *Secr.* R. S. *concerning the* Poiſon of Laurel-Water.

*Dear Doctor,* *Dublin, May* 17. 1732.

I Received thine of *Feb.* 15. with the *Tranſactions* Nº 418 and 420. giving an Account of the Experiments upon *Laurel-Water*. I wiſh your Experiments with the Milk, had more fully determin'd and aſcertain'd it to be an Antidote, than they have yet done. I am informed by Dr. ——— that ſome Apothecaries in *England*, being uſed to ſophiſticate *Black-Cherry-Water* with *Laurel-Leaves*, will not be perſuaded, that this is a Poiſon on human Bodies, notwithſtanding our few Inſtances. I can now confirm that it really is ſo by this Story, which thou mayſt be aſſured of the Truth of.

At *Liſminy* in *Weſtmeath*, a Girl of 18 Years old, very well and healthy, took a Quantity, leſs than two Spoonfuls, of the firſt Runnings of the *Simple Water of Laurel-Leaves*; whereupon within half a Minute ſhe fell down, was convulſed, foamed at the Mouth, and died in a ſhort time, nor was there any Swelling on her Body.

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SOCIETY. M.DCC.XLII.

*N. B.* The *Philoſophical Tranſactions* being three Years behindhand in regard of Time, we ſhall skip over 10 Numbers, and commence the *Tranſactions* for the current Year 1742. and the XLIId Volume with N° 462. and ſo continue to publiſh the Papers for the future in the preciſe Order of the Times of their being read before the *Royal Society*; in the mean time this XLIſt Volume, or the *Tranſactions* from N° 452. to 462. ſhall be filled up with all poſſible Speed.

Numb. 453.

# PHILOSOPHICAL TRANSACTIONS.

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# I. *Tentaminis de Menſura & Motu aquarum fluentium, præcedente Tranſactionum Numero communicati, pars reliqua; Auctore* Jacobo Jurin, *M. D. Soc. Reg. & Colleg. Medic.* Londinenſ. *Sodale.*

## *De Reſiſtentia partium aquæ inter ſe, ex defectu lubricitatis oriunda.*

PRiuſquam ulterius progrediamur, expendenda eſt ea *Reſiſtentia* fluidorum, quæ oritur ex motu partium eorundem inter ſe, quamque *Newtono* auctore vocamus *Reſiſtentiam* ex defectu lubricitatis oriundam.

Hanc ille duplicem ſtatuit, alteram quæ oritur ex tenacitate fluidi, alteram quæ fit attritu, ſeu affrictu mutuo partium fluidi inter ſe.

Priorem, data ſuperficie, uniformem eſſe cenſet, ſeu effectum edere tempori proportionalem; & favent experimenta: poſteriorem opinatur augeri in ratione velocitatis, vel ratione paulo minori. Sed de hac nihil diſerte ſtatuit, cum deſint idonea experimenta.

Diverſam autem rationem inter ſe invicem obtinent hæ duæ Reſiſtentiæ, non ſolum pro diverſitate fluidi, quum oleo, ex. gr. aut ſevo liquefacto major inſit tenacitas quam aquæ, minor attritus; ſed etiam in fluido eodem, pro diverſa velocitate qua moventur partes fluidi inter ſe. In dato autem fluido datur neceſſario certa aliqua velocitas, ubi pares inter ſe invicem ſint hæ reſiſtentiæ; & ſi iſtam velocitatem experimento reperire liceret, poſſet in aliis quibuſcunque velocitatibus earundem proportio determinari. Experimenta vero nulla habemus, quod ſciam, nec facile eſt ulla excogitare, quorum ope cognoſci queat iſta velocitas, quæ cæteris pro fundamento inſervire poſſit.

Suſpicamur quidem, immo pro veriſimili habemus non una de cauſa, quamminimam in aqua eſſe velocitatem iſtam fundamentalem, ubi reſiſtentiæ ex tenacitate & ex affrictu oriundæ æquales ſunt inter ſe. Hoc autem conceſſo, cum creſcente velocitate creſcat pariter reſiſtentia ex affrictu, nullatenus vero creſcat reſiſtentia ex tenacitate, patet ultimam hanc reſiſtentiam non niſi parvam admodum rationem obtinere ad priorem, ubi partes fluidi notabili aliqua velocitate moventur inter ſe; & proinde tuto negligi poſſe.

Cæterum, ſive hac neglecta, alteram ſolam reſiſtentiam, quæ ex affrictu oritur, ſive utramque comprehendi oporteat nomine *Reſiſtentiæ* ex defectu lubricitatis oriundæ, leges certe, quibus creſcat aut minuatur hæc *Reſiſtentia*, non niſi ab experientia ſunt petendæ. Sequentes itaque creſcendi leges cum ei tribuimus, etſi poſt diligentem experimentorum hactenus factorum conſiderationem, magnam veri ſimilitudinem habere videantur, id tamen eo animo facimus, ut ſi quid certius docuerint experimenta in poſterum inſtituenda, ſententiam non inviti mutemus.

## HYPOTHESIS.

*Reſiſtentia*, quæ oritur ex defectu lubricitatis aquæ, eſt in ratione compoſita ex tribus ſequentibus:

1. Ex ratione ſuperficiei partium quæ moventur. Hoc, puto, admittunt omnes Philoſophi.

2. Ex ratione velocitatis relativæ, qua moventur partes aquæ inter ſe. Hoc a reliquis, ni fallor, admittitur, nec multum diſſentit *Newtonus*.

3. Ex ratione ſubduplicata altitudinis aquæ. Id nos adſumimus, duce experientia, & aliquatenus etiam

auctore *Newtono*, qui cenſet majori preſſione fieri attritum partium fortiorem, & ſeparationem ab invicem difficiliorem. *Princip. Lib.* II. *Prop.* LII. *Schol.*

## PROBLEMA VIII.

*Exponere reſiſtentiam partium* Cataractæ, *quæ oritur ex defectu lubricitatis.*

Sit $r$ radius foraminis, $A$ altitudo *Cataractæ*, $y$ radius cujuſlibet ſectionis horizontalis, $x$ altitudo *Cataractæ* ſupra iſtam ſectionem, $z$ radius circuli cujuſvis in iſta ſectione, $v$ velocitas aquæ in centro foraminis.

Erit modo $\frac{vx^{\frac{1}{2}}}{A^{\frac{1}{2}}}$ velocitas aquæ in centro ſectionis, cui radius $y$. Nam velocitas in centro ſectionis eadem eſt ac ſi ſectio iſta eſſet foramen in fundo vaſis decurtati, cui altitudo $x$; adeoque eſt ut $x^{\frac{1}{2}}$ per Corollarium Probl. VI. Erit etiam $\frac{y-z}{y} \times \frac{vx^{\frac{1}{2}}}{A^{\frac{1}{2}}}$ velocitas aquæ in circumferentia circuli, cui radius $z$; $\frac{\dot{z}vx^{\frac{1}{2}}}{yA^{\frac{1}{2}}}$ velocitas relativa; $2mz\dot{x}$ ſuperficies cylindri naſcentis, cui radius $z$, altitudo $\dot{x}$; eritque per tres noſtras poſitiones, *Reſiſtentia* ſuperficiei hujus cylindri, ut $2mz\dot{x} \times \frac{\dot{z}vx^{\frac{1}{2}}}{yA^{\frac{1}{2}}} \times x^{\frac{1}{2}} = \frac{2mvx\dot{x}z\dot{z}}{yA^{\frac{1}{2}}}$.

Conſiderentur jam $\dot{x}$, $x$, & $y$ ut quantitates conſtantes, dum fluit $z$ uſque donec evadit æqualis ipſi $y$;

& erit fluxionis $\frac{2mv\dot{x}x\dot{z}z}{yA^{\frac{1}{2}}}$, quantitas fluens $\frac{2mv\dot{x}xz^2}{2yA^{\frac{1}{2}}}$, ſive $\frac{mv\dot{x}xz^2}{yA^{\frac{1}{2}}}$, ſive, (ponendo $z=y$) $\frac{mv\dot{x}xy}{A^{\frac{1}{2}}}$, ut reſiſtentia cylindri naſcentis, cui radius $y$, altirudo $\dot{x}$.

Sed per proprietatem curvæ *Catarace*, $y^4x=r^4A$, & $yx^{\frac{1}{4}}=rA^{\frac{1}{4}}$: unde *Reſiſtentia* cylindri hujus naſcentis erit ut $\frac{mv\dot{x}xrA^{\frac{1}{4}}}{A^{\frac{1}{2}}x^{\frac{1}{4}}}$, ſive ut $\frac{mvr\dot{x}x^{\frac{3}{4}}}{A^{\frac{1}{4}}}$; & *Reſiſtentia* totius *Cataractæ* erit ut hujus fluxionis quantitas fluens, ſive ut $\frac{mvrx^{\frac{7}{4}}}{A^{\frac{1}{4}}}\times\frac{4}{7}$, ſive, ponendo $x=A$, ut $\frac{4}{7}mvrA^{\frac{3}{2}}$. Et cum per *Problema* IV. ſit $v=3qV$, erit *Reſiſtentia* in *Cataracta*, ut $\frac{12qmVrA^{\frac{3}{2}}}{7}$, ſive ut $qVrA^{\frac{3}{2}}$. Q.E.I.

COROLL. Cum ſit $V$ ut $\sqrt{A}$, erit *Reſiſtentia* in *Cataracta*, ut $qrA^2$.

## SCHOLIUM.

In ſolutione modo expoſita, pro ſuperficie talcolæ *Cataracticæ*, cui radius $z$, ſecundum quam particulæ aqueæ ſe mutuo præterfluunt velocitate relativa æquabili, adhibuimus ſuperficiem cylindri naſcentis, cui radius $z$, altitudo $\dot{x}$, ſive ſuperficiem $2mz\dot{x}$, cum revera ejus talcolæ ſuperficies ſit $2mz\times\sqrt{\dot{x}^2+\dot{z}^2}$.

Id autem ſi corrigatur, invenietur *Reſiſtentia* ſuperficiei hujus talcolæ ut $2mz\sqrt{\dot{x}^2+\dot{z}^2}\times x^{\frac{1}{2}}\times\frac{\dot{z}vx^{\frac{1}{2}}}{yA^{\frac{1}{2}}}$ $=\frac{2mvx\dot{z}z\sqrt{\dot{x}^2+\dot{z}^2}}{yA^{\frac{1}{2}}}$.

Cumque, per *Scholium* 2. *Problematis* II. ſubtangens curvæ *Cataracticæ* ſit $4x$, & tangens ipſa $\sqrt{16x^2+z^2}$, erit $4x:\sqrt{16x^2+z^2}::\dot{x}:\sqrt{\dot{x}^2+\dot{z}^2}$ $=\frac{\dot{x}\sqrt{16x^2+z^2}}{4x}$.

Itaque *Reſiſtentia* ſuperficiei talcolæ erit ut $\frac{2mvx\dot{z}z}{yA^{\frac{1}{2}}}\times\frac{\dot{x}}{4x}\sqrt{16x^2+z^2}=\frac{mv\dot{x}}{2yA^{\frac{1}{2}}}\dot{z}z\sqrt{16x^2+z^2}$ $=\frac{mv\dot{x}\dot{z}z}{2yA^{\frac{1}{2}}}$ in $4x+\frac{z^2}{2\times4x}-\frac{z^4}{8.\overline{4x}^3}+\frac{z^6}{16\times\overline{4x}^5}$ $-\frac{5z^8}{128\times\overline{4x}^7}+\frac{7z^{10}}{256\times\overline{4x}^9}$ &c. $=\frac{mv\dot{x}}{2yA^{\frac{1}{2}}}$ in $4x\dot{z}z$ $+\frac{\dot{z}z^3}{2\times4x}-\frac{\dot{z}z^5}{8\times\overline{4x}^3}+\frac{\dot{z}z^7}{16\times\overline{4x}^5}-\frac{5zz^9}{128\times\overline{4x}^7}$ $+\frac{7\dot{z}z^{11}}{256\times\overline{4x}^9}-\frac{21\dot{z}z^{13}}{1024\times\overline{4x}^{11}}$ &c.

Habendo autem quantitates $\dot{x}$, $x$, & $y$ pro conſtantibus, hujus fluxionis fluens erit, $\frac{mv\dot{x}}{2yA^{\frac{1}{2}}}$ in $\frac{4xz^2}{2}$ $+\frac{z^4}{8\times4x}-\frac{z^6}{48\times\overline{4x}^3}+\frac{z^8}{8\times16\times\overline{4x}^5}-\frac{z^{10}}{256\times\overline{4x}^7}$ $+\frac{7z^{12}}{12\times256\times\overline{4x}^9}-$&c.

Et ponendo $z=y$, erit hæc fluens $\frac{mv\dot{x}}{2A^{\frac{1}{2}}}$ in $2xy + \frac{y^3}{8\times 4x} - \frac{y^5}{48\times\overline{4x}^3} + \frac{y^7}{8\times 16\times\overline{4x}^5} - \frac{y^9}{256\times\overline{4x}^7} + \frac{7y^{11}}{12\times 256\times\overline{4x}^9}$ — &c. quæ erit ut *Reſiſtentia* in taleola Cataractica, cui radius $y$, altitudo $\dot{x}$.

Hæc autem eſt ut fluxio *Reſiſtentiæ* in tota *Cataracta*, & ponendo $y=\frac{rA^{\frac{1}{4}}}{x^{\frac{1}{4}}}$, ſit $\frac{mv\dot{x}}{2A^{\frac{1}{2}}}$ in $\frac{2rxA^{\frac{1}{4}}}{x^{\frac{1}{4}}} + \frac{r^3A^{\frac{3}{4}}}{8\times 4\times x^{\frac{7}{4}}} - \frac{r^5A^{\frac{5}{4}}}{48\times 4^3\times x^{\frac{17}{4}}} + \frac{r^7A^{\frac{7}{4}}}{8\times 16\times 4^5\times x^{\frac{27}{4}}} - \frac{r^9A^{\frac{9}{4}}}{256\times 4^7\times x^{\frac{37}{4}}}$ + &c. $=\frac{mvr}{2A^{\frac{1}{4}}}$ in $2\dot{x}x^{\frac{3}{4}} + \frac{r^2A^{\frac{1}{2}}\dot{x}x^{-\frac{7}{4}}}{32} - \frac{r^4A\dot{x}x^{-\frac{17}{4}}}{48\times 4^3} + \frac{r^6A^{\frac{3}{2}}\dot{x}x^{-\frac{27}{4}}}{8\times 16\times 4^5}$ — &c. Hujus autem fluxionis quantitas fluens eſt $\frac{mvr}{2A^{\frac{1}{4}}}$ in $2x^{\frac{7}{4}}\times\frac{4}{7} + \frac{r^2A^{\frac{1}{2}}x^{-\frac{3}{4}}}{32}\times-\frac{4}{3} - \frac{r^4Ax^{-\frac{13}{4}}}{48\times 4^3}\times-\frac{4}{13} + \frac{r^6A^{\frac{3}{2}}x^{-\frac{23}{4}}}{8\times 16\times 4^5}\times-\frac{4}{23}$ — &c. Hæc autem, ponendo $x=A$, ſit $\frac{mvr}{2}$ in $\frac{8A^{\frac{3}{2}}}{7} - \frac{r^2}{3\times 8A^{\frac{1}{2}}} + \frac{r^4}{12\times 13\times 4^3A^{\frac{5}{2}}} - \frac{r^6}{32\times 23\times 4^5A^{\frac{9}{2}}}$ + &c. ſive, $\frac{4mvrA^{\frac{3}{2}}}{7}$ in $1 - \frac{7r^2}{3\times 4^3A^2} + \frac{7r^4}{6\times 13\times 4^5A^4} - \frac{7r^6}{23\times 4^9A^6}$ + &c. quæ eſt ut *Reſiſtentia* per totam *Cataractam*.

Quod ſi altitudo pro infinita habeatur reſpectu diametri foraminis, erit *Reſiſtentia* ut $\frac{4mvrA^{\frac{3}{2}}}{7}$, prorſus uti definitum eſt in ſolutione priori.

Si $A = 10r$, *Reſiſtentia* crit ut $\frac{4mvrA^{\frac{3}{2}}}{7} \times \overline{1 - \frac{1}{2743}}$ circiter.

Si $A = 4r$, *Reſiſtentia* crit ut $\frac{4mvrA^{\frac{3}{2}}}{7} \times \overline{1 - \frac{1}{439}}$ circiter.

Poteſt itaque uſurpari $\frac{4mvrA^{\frac{3}{2}}}{7}$ pro menſura *Reſiſtentiæ*, abſque periculo ſenſibilis erroris, etiam ubi altitudo aquæ non ſuperat duas diametros foraminis, & multo magis in altitudine longe majori.

## PROBLEMA IX.

*Data* Menſura *aquæ effluentis per datum foramen circulare in medio fundo vaſis cylindrici datæ altitudinis, definire* Menſuram *aquæ effluentis ex alio vaſe cujuſcunque altitudinis datæ per foramen circulare quodcunque datum.*

Sit $r$ radius foraminis dati, $A$ altitudo data, $2qmr^2A$ data *Menſura* aquæ effluentis illo tempore, quo caſurum in vacuo ſit corpus grave per altitudinem $A$.

Hinc erit, per *Problema* IV. $3q^2mr^2AV$ *Motus* aquæ eodem tempore effluentis: eritque, per *Corollarium Problematis* IV. *Motus* eodem tempore per *Reſiſtentiam* deperditus, $mr^2AV \times \overline{1 - 3q^2}$. Hunc itaque

*Motum* vis æqualis *Reſiſtentiæ* generare poteſt eodem tempore.

Sunt autem *Motus* eodem temporis ſpatio generati viribus eoſdem generantibus proportionales.

Itaque *Motus* $mr^2AV$, quem hoc tempore generare poteſt, per *Problema* I. pondus columnæ aqueæ $mr^2A$, cum abeſt omnis *Reſiſtentia*, eſt ad *Motum* $mr^2AV\times\overline{1-3q^2}$, quem eodem tempore generare poteſt *Reſiſtentia*, ut pondus $mr^2A$, ad ipſam *Reſiſtentiam*. Unde *Reſiſtentia* $=mr^2A\times\overline{\frac{mr^2AV\times\overline{1-3q^2}}{mr^2AV}}$ $=mr^2A\times\overline{1-3q^2}$.

Eodem modo, ponendo $s$ & $E$ pro radio foraminis, & altitudine novi vaſis, & $2pms^2E$ pro *Menſura* aquæ effluentis eodem tempore, quo caſurum ſit in vacuo corpus grave per altitudinem $E$, habebis *Reſiſtentiam* in novo vaſe $=ms^2E\times\overline{1-3p^2}$.

Sed per *Corollarium Problematis* VIII. ſunt ad invicem hæ duæ *Reſiſtentiæ* ut $qrA^2$ ad $psE^2$.

Itaque, $mr^2A\times\overline{1-3q^2} : ms^2E\times\overline{1-3p^2} :: qrA^2 : psE^2$, ſive $r\times\overline{1-3q^2} : s\times\overline{1-3p^2} :: qA : pE$, ſive $prE\times\overline{1-3q^2}=qsA\times\overline{1-3p^2}$, qua æquatione rite reducta pervenitur ad ſequentem,

$$p=\sqrt{\tfrac{1}{3}+\overline{\frac{rE\times\overline{1-3q^2}}{6qsA}}\Big|^{2}}-\frac{rE\times\overline{1-3q^2}}{6qsA},$$

vel ponendo $rE=nsA$,

$$p=\sqrt{\tfrac{1}{3}+\overline{\frac{n\times\overline{1-3q^2}}{6q}}\Big|^{2}}-\frac{n\times\overline{1-3q^2}}{6q}.$$

Unde habetur $p \times 2ms^2E$, quæ eſt *Menſura* aquæ effluentis ex ſecundo vaſe, quo tempore cadit in vacuo corpus grave per altitudinem *E*. Q. E. I.

Coroll. 1. Si diametri foraminum fuerint in ratione altitudinum aquæ, eadem erit ratio *Menſurarum*, ac ſi aqua efflueret ſine ulla *Reſiſtentia*.

Nam, ſi $r : s :: A : E$, $rE = sA$, & $n = 1$, unde $p = \sqrt{\frac{1}{3} + \overline{\frac{1-3q^2}{6q}}\Big|^2}$ min. $\frac{1-3q^2}{6q}$, & per reductionem $p = q$; unde $2qmr^2A : 2pms^2E :: 2mr^2A : 2ms^2E$, quæ eſt ratio *Menſurarum*, cum abeſt omnis *Reſiſtentia*.

Coroll. 2. Si *E* pro nihilo habeatur reſpectu altitudinis *A*, habenda eſt etiam *n* pro nihilo, unde fit $p = \frac{1}{\sqrt{3}}$. Itaque, quo minor capitur altitudo *E*, eo propius vergit *p* ad $\frac{1}{\sqrt{3}}$.

Coroll. 3. Si *s* pro infinite magno habeatur reſpectu radii *r*, fit $p = \frac{1}{\sqrt{3}}$. Itaque quo major capitur radius *s*, eo magis vergit *p* ad $\frac{1}{\sqrt{3}}$.

## PROBLEMA X.

*Aqua in aërem effluente determinare rationem inter diametrum foraminis & diametrum venæ contractæ.*

Hæc ratio ſine experimentorum ope determinari nequit. Eſt equidem, per *Problema* VII,

$$\rho^2 = \frac{qVr^2}{v^2} \times \overline{v + 6qV - 2\sqrt{3qvV + 9q^2V^2 - 2v^2}},$$

unde cognitis $q$ & $v$ definitur $\rho$.

Sed nulla, quod ſciam, habemus experimenta, quibus utramque harum quantitatum $q$ & $v$ metiamur.

*Poleni* ſiquidem experimenta *Menſuram* aquæ effluentis exhibent, unde cognoſcitur $q$; ſed diſtantiam maximam, ad quam fertur aqua ex foramine horizontaliter proſiliens, ſive diſtantiam, ad quam pertingit media pars venæ, quæ velocitate $v$ exilit, non deſignant.

*Mariotti* vero experimenta altitudinem maximam perpendicularem, ad quam proſilit aqua motu ſurſum verſo, ſive altitudinem, quam attingit aqua ex media vena proſiliens, metiuntur, unde cognoſcitur $v^2$; ſed non exhibent *Menſuram* aquæ effluentis.

Deficientibus itaque idoneis experimentis, vix licebit rationem eam, quam quærimus, niſi præterpropter determinare. Id autem fiet in modum ſequentem.

In *Scholio* 2. *Problematis* VII, veriſimile eſſe docuimus conſtantem eſſe rationem inter hos radios, aut ſaltem non niſi quamminimum mutari.

Conſtat autem ex *Mariotti* experimentis diſcrimen inter altitudinem, quam attingit aqua ſurſum exiliens, & altitudinem vaſis, rationem obtinere duplicatam circiter ipſius altitudinis vaſis.

Itaque, ſi $a$ ſit altitudo, ad quam motu ſurſum verſo ſalire poſſit aqua fluens per axem venæ cum velocitate $v$; erit ex *Mariotti* experimentis, $A - a$ ut $A^2$, & erit $\frac{A^2}{A - a}$ data quantitas.

Sed in uno experimento, quod pro fundamentali habet *Mariottus*, fuit $A = 60$ digit. Pariſienſ. & inventa eſt $a = 59$ digit. Pariſ. diametro foraminis metiente digitum dimidium. Fuit itaque in hoc caſu $\frac{A^2}{A-a} = 3600$, cumque data ſit hæc quantitas, erit ſemper $3600\,a = 3600\,A - A^2$, vel $a = \frac{3600\,A - A^2}{3600}$ $= A - \frac{A^2}{3600}.$

Ergo, ſi ſit $A = 1$ dig. ſive dupla diametri foraminis, erit $a = 1 - \frac{1}{3600}$. Sed $v^2 : V^2 :: a : A :: 1 - \frac{1}{3600} : 1.$

Itaque, cum altitudo vaſis dupla eſt diametri foraminis, haberi poteſt $v^2 = V^2$, vel $v = V$.

Porro, per *Coroll.* 4. *Probl.* IX. decreſcente $E$, vergit $p$ ad $\frac{1}{\sqrt{3}}$.

Itaque, cum ſit altitudo vaſis valde parva, velut ſi non ſuperet duas diametros foraminis, haberi poteſt $p$ vel $q = \frac{1}{\sqrt{3}}$.

Sed, per *Problema* VII,

$$\varrho^2 = \frac{qVr^2}{v^2} \times \overline{v + 6qV - 2\sqrt{3qvV + 9q^2V^2} - 2v^2},$$

& pro $v$ & $q$ ſubſtituendo valores eorundem modo inventos, ſive $V$ & $\frac{1}{\sqrt{3}}$, fit

$$\varrho^2 = \frac{r^2}{V\sqrt{3}} \times \overline{V + 2V\sqrt{3} - 2\sqrt{V^2\sqrt{3} + 3V^2} - 2V^2}$$

$= \frac{r^2}{\sqrt{3}} \times \overline{1+2\sqrt{3}-2\sqrt{1+\sqrt{3}}}$, ſive

$\varrho^2 = r^2 \times \overline{2+\frac{1}{\sqrt{3}}-2\sqrt{1+\sqrt{3}}} = r^2 \times 0{,}6687553907$

unde $\varrho = r \times 0{,}81777466$.

Hic itaque eſt valor ipſius $\varrho$, cum altitudo aquæ dupla eſt diametri foraminis; & cum per *Scholium* 2. *Problematis* VII. $\varrho$ conſtantem obtineat rationem ad radium foraminis, obtinebit eundem valorem in quacunque altitudine aquæ. Q. E. I.

COROLL. I. Per *Problema* VII,

$R = \frac{\varrho}{3} \times {}^{2}\frac{\overline{\;+r}}{\sqrt{3\varrho^2-2r^2}}$, & ex modo invento valore ipſius $\varrho$, habetur $R = r \times 3{,}98877150$, qui eſt valor ipſius $R$, cum altitudo aquæ dupla eſt diametri foraminis; cumque per *Scholium* 2. ejuſdem *Problematis*, conſtans habeatur ratio inter $r$ & $R$, obtinebit $R$ hunc ipſum valorem, quæcunque fuerit altitudo aquæ.

COROLL. II. Quoniam $v$ eſt fere æqualis ipſi $V$, & $q$ eſt fere $= \frac{1}{\sqrt{3}}$, ubi altitudo aquæ dupla eſt diametri foraminis; erit ad hanc altitudinem aquæ, $\frac{v}{qV} = \sqrt{3}$ quamproxime. Et cum, per *Scholium* 2. *Problematis* VII, conſtans ſit ratio inter $v$ & $qV$, erit $\frac{v}{qV} = \sqrt{3}$, quæcunque fuerit aquæ altitudo.

## PROBLEMA XI.

*Aqua ex dato vaſe ſemper pleno per datum foramen in aërem effluente, & data una quavis ex tribus quantitatibus ſequentibus, nempe* Menſura *aquæ effluentis,* velocitate *in axe venæ contractæ, aut* altitudine, *ad quam motu ſurſum verſo ſalire poſſit media pars venæ, reliquas duas determinare.*

Sit $A$ altitudo vaſis, $r$ radius foraminis, $2qmr^2A$ *Menſura* aquæ effluentis, $v$ velocitas in axe venæ contractæ, $a$ altitudo, ad quam ſalire queat aqua effluens per axem venæ, & detur primo $2qmr^2A$, unde datur $q$.

Per *Corollarium* 2. *Problematis* X. $\frac{v}{qV}=\sqrt{3}$, unde $v=qV\sqrt{3}$. Hinc $v^2=3q^2V^2$. Sed $V^2:v^2::A:a=\frac{v^2A}{V^2}=\frac{3q^2V^2A}{V^2}=3q^2A$.

Si ſecundo detur $v$, erit $q=\frac{v}{V\sqrt{3}}$, &

$2qmr^2A=\frac{2mr^2Av}{V\sqrt{3}}$.

Porro $a=\frac{v^2A}{V^2}$.

Poſtremo, ſi detur $a$, cum ſit $a=3q^2A$, erit $q^2=\frac{a}{3A}$,

& $q=\sqrt{\frac{a}{3A}}$.

Item $v^2=\frac{aV^2}{A}$, unde $v=V\sqrt{\frac{a}{A}}$. Q.E.I.

## PROBLEMA XII.

*Data altitudine, ad quam motu ſurſum verſo ſalit aqua per aërem erumpens ex vaſe altitudinis datæ per datum foramen circulare, definire altitudinem, ad quam aqua motu ſurſum verſo aſcenſura ſit, cum erumpit ex vaſe cujuſcunque altitudinis datæ per foramen circulare quodcunque datum.*

Significentur literis, $r$, $s$, $A$, $E$, $q$, $p$, res eædem atque in *Problemate* IX; ſintque $a$ & $e$ altitudines, ad quas ſalire queat aqua erumpens ex vaſis, quibus altitudines $A$ & $E$ reſpective.

Erit jam, per *Problema* XI, $a = 3q^2A$, $e = 3p^2E$, unde $3q^2 = \frac{a}{A}$, $1 - 3q^2 = \frac{A-a}{A}$, $q = \sqrt{\frac{a}{3A}}$, $p = \sqrt{\frac{e}{3E}}$, & $p^2 = \frac{e}{3E}$.

Cumque, per *Problema* IX, ſit

$$p = \sqrt{\tfrac{1}{3} + \left.\overline{\frac{rE \times \overline{1 - 3q^2}}{6qsA}}\right|^2} - \frac{rE \times \overline{1 - 3q^2}}{6qsA}, \text{ vel}$$

ponendo $rE = nsA$, $p = \sqrt{\tfrac{1}{3} + \left.\overline{n \times \frac{\overline{1 - 3q^2}}{6q}}\right|^2} - n \times \frac{\overline{1 - 3q^2}}{6q}$;

hinc ſubſtituendo $\frac{A-a}{A}$ pro $1 - 3q^2$, & $\sqrt{\frac{a}{3A}}$ pro $q$, ac pro $A - a$ ſcribendo $\alpha$, evadet

$$p = \frac{\sqrt{4Aa + n^2\alpha^2} - n\alpha}{2\sqrt{3Aa}}, \text{ \&}$$

$$p^2 = \frac{2Aa + n^2\alpha^2 - n\alpha\sqrt{4Aa + n^2\alpha^2}}{6Aa};$$

Sed $p^2 = \frac{e}{3E}$, unde $\frac{e}{E} = \frac{2Aa + n^2\alpha^2 - n\alpha\sqrt{4Aa+n^2\alpha^2}}{2Aa}$, ſive $e = E \times \frac{2Aa + n^2\alpha^2 - n\alpha\sqrt{4Aa+n^2\alpha^2}}{2Aa}$, unde ſcribendo $\varepsilon$ pro $E - e$, fit $\varepsilon = \frac{nE\alpha}{2Aa} \times \overline{\sqrt{4Aa+n^2\alpha^2} - n\alpha}$. Data autem $\varepsilon$, ſive $E - e$, datur $e$, ſive altitudo ad quam aqua fertur, cum ex novo vaſe erumpit. Q. E. I.

COROLL. 1. Si æqualia fuerint foramina in utroque vaſe, ſeu $s = r$, erit $E = nA$, vel $n = \frac{E}{A}$, unde $\varepsilon = \frac{n^2\alpha}{2a} \times \overline{\sqrt{4Aa+n^2\alpha^2} - n\alpha}$.

COROLL. 2. Si æquales fuerint vaſorum altitudines, ſeu $E = A$, erit $r = ns$, ſeu $n = \frac{r}{s}$, unde $\varepsilon = \frac{n\alpha}{2a} \times \overline{\sqrt{4Aa+n^2\alpha^2} - n\alpha}$.

COROLL. 3. Si diametri foraminum fuerint in ratione altitudinum, ſalient aquæ ad altitudines ipſis vaſorum altitudinibus proportionales. Nam, ſi $r : s :: A : E$, $rE = sA$, & $n = 1$, unde $\varepsilon = \frac{E\alpha}{A}$, ſeu $\varepsilon : \alpha :: E : A$, vel $E - e : A - a :: E : A$, ſive $e : a :: E : A$.

COROLL. 4. Cum ſit $p \times 2\sqrt{3Aa} = \overline{\sqrt{4Aa+n^2\alpha^2} - n\alpha}$, erit $\varepsilon = \frac{nE\alpha}{2Aa} \times 2p\sqrt{3Aa} = \frac{pnE\alpha\sqrt{3}}{\sqrt{Aa}}$, unde pro $\sqrt{a}$ ſubſtituendo ejus valorem ſuprapoſitum, $q\sqrt{3A}$, & reductione debita, fit $\varepsilon = \frac{pnE\alpha}{qA}$, ſive $\varepsilon = \frac{prE^2\alpha}{qsA^2}$.

COROLL. 5. Hinc autem ponendo $p=q$, $\varepsilon=\frac{rE^2\alpha}{sA^2}$, ſive $\varepsilon : \alpha :: rE^2 : sA^2$. Hoc eſt, defectus altitudinum aquarum ſalientium, ſive diſcrimina inter altitudines ſalientium, & altitudines vaſorum, ſunt in ratione compoſita ex ratione duplicata altitudinum vaſorum directe, & ratione diametrorum foraminum reciprocé. Hæc autem regula accuratè vera eſt, ubi $sA=rE$, per *Coroll.* 1. *Probl.* IX; & proxime ad verum accedit, ubi $E$ & $s$ in eadem circiter ratione augentur, vel minuuntur; nec niſi paulum aberrat a vera aquæ ſalientis altitudine in quocunque caſu, modo $E$ non ſit major pedibus 50, & eodem tempore $s$ non ſit minor lineis 3.

COROLL. 6. Ubi $s=r$, $\varepsilon=\frac{E^2\alpha}{A^2}$ circiter, hoc eſt, ubi paria ſunt foramina, defectus altitudinum aquarum ſalientium ſunt fere in ratione duplicata altitudinum vaſorum, quæ eſt ipſa *Mariotti* regula.

COROLL. 7. Ubi $E=A$, $\varepsilon=\frac{r\alpha}{s}$ circiter, hoc eſt, ubi pares ſunt altitudines vaſorum, defectus aquarum ſalientium ſunt fere ut diametri foraminum reciprocé.

### SCHOLIUM GENERALE I.

Theoriæ ſupratraditæ fidem ſi quis experimentis inſtituendis explorare voluerit, ei auctor ſim,

1. Vaſe uti ampliſſimo, ſaltem in parte ſuperiori, eum in finem ut toto tempore, quo capitur experimentum, altitudo aquæ ad ſenſum non mutetur.

Quod ſi vas ita amplum non ſit, quin durante effluxu ex foramine decrementum altitudinis aquæ notatu dignum reperiatur, habenda eſt pro conſtanti altitudine altitudo debita intermedia inter maximam & minimam aquæ altitudinem; quod fieri præſtat, quam motum aquæ naturalem perturbare affundendo deſuper aquam novam.

2. Vaſis altitudo tanta ſit, ut ſi aquam per foramen in latere factum emittere velis, velocitas aquæ per centrum foraminis exituræ tuto haberi poſſit pro velocitate quacum aqua per totum foramen exitura ſit, cum abeſt omnis reſiſtentia.

3. Lamina, in quo fit foramen, tam tenuis ſit, aut ſaltem acie tam tenui in ambitu foraminis, ut ejus aciei craſſities pro nihilo haberi poſſit reſpectu diametri foraminis. Debet autem recidi craſſities laminæ facie externa, relicta plana facie interiore proxime aquam: & angulum hujus aciei tam acutum eſſe oportet, ut aqua per foramen effluens lateri exteriori laminæ non adhæreſcat.

His paratis ſequentia inſtitui poterunt experimenta, quibus quaſi totidem criteriis de certitudine doctrinæ ſuprapoſitæ dijudicari queat.

Experimentum 1. Cum aqua per foramen in latere vaſis emittitur, menſuretur diligentiſſime diameter venæ contractæ, notando utrum ſemper ſibi conſtet mutata utcunque altitudine aquæ.

Exper. 2. Obſervetur etiam utrum hæc diameter eandem ſemper obtineat rationem ad diametrum foraminis, cum foramina diverſæ magnitudinis uſurpantur.

Exper. 3. Aqua effluente vel recta deorſum per fundum vaſis, vel horizontaliter per latus ejuſdem, obſervetur accuratiſſime quantum effluat dato tempore, adhibendo diverſas altitudines aquæ, ſed unum idemque foramen.

Exper. 4. Idem obſervetur, cum foramina diverſæ magnitudinis uſurpantur, ſed eadem adhibetur altitudo aquæ.

Exper. 5. Obſervandum quantum effluat dato tempore in caſibus duobus diverſis, quorum in utroque eadem ſit ratio diametri foraminis ad altitudinem aquæ. Nam ſi *Menſuræ* reperientur in ratione compoſita ex ratione duplicata diametrorum, & ratione ſimplici altitudinum, ut in *Coroll.* 3. *Problematis* IX, magnam habebis Theoriæ noſtræ confirmationem.

Exper. 6. In iiſdem duobus caſibus, motu aquæ ſurſum verſo ope tubi ampli lateri vaſis adaptati, & ſuperiori parte foramine pertuſi, obſervetur ad quantas altitudines aqua ſaliat. Nam ſi reperientur hæ altitudines proportionales altitudinibus aquæ in vaſe, ut in *Corollario* 3. *Problematis* XII, habebis alteram hujus Theoriæ certiſſimam confirmationem.

Exper. 7. Eodem manente foramine, ſed mutata utcunque altitudine aquæ, obſervandum ad quantam altitudinem feratur aqua.

Exper. 8. Idem obſervetur, cum eadem perſtante altitudine aquæ mutatur foraminis magnitudo.

Cæterum, ex omnibus his experimentis præferenda ſunt ea, quibus motu aquæ ſurſum verſo notatur altitudo ad quam aqua ſalit. Hæc enim altitudo & facilius longe capi poteſt, quam *Menſura* aquæ effluentis, & error, ſi quis forte admittatur in capienda altitudine, longe minoris eſt momenti, quam qui admittitur in *Menſura* æſtimanda. Cum enim, per

*Problema* XI, altitudo aquæ ſalientis ſit $3\,q^2 A$, patet, quod error minimus admiſſus in *Menſura*, ſive in $q$, duplicabitur fere in $q^2$, adeoque duplicabitur in altitudine aquæ ſalientis.

At minimus error admiſſus in altitudine aquæ ſalientis, ſive in $3\,q^2 A$, redigitur fere ad dimidium in æſtimanda $q$, hoc eſt, in *Menſura* aquæ effluentis.

## SCHOLIUM GENERALE II.

Interim, dum ab iis, quibus otium non minus quam veri cognoſcendi ſtudium ſuppetit, fiant aliquando iſta experimenta, utendum, quantum fieri poteſt, iis experimentis quæ nobis ſuppeditavit anteceſſorum diligentia.

Hæc autem ſunt triplicia. Nam metiuntur vel,

1. Diametrum venæ contractæ; vel,
2. *Menſuram* aquæ effluentis; vel,
3. Altitudinem ad quam aqua ſalit.

1. Venæ contractæ radius menſurante *Newtono* eſt $r \times 0,84$, cum diameter foraminis eſt $\frac{5}{8}$ digiti *Londinenſis*.

Idem *Poleno* dimetiente eſt $r \times 0,78$ circiter, cum diameter foraminis eſt digitorum *Pariſienſium* $2\frac{1}{6}$.

Per calculum noſtrum eſt $r \times 0,818$ fere, quæcunque fuerit diameter foraminis. Quæ magnitudo eſt intermedia circiter inter menſuram *Newtonianam* & *Polenianam*.

2. Perincommode accidit, ut *Menſuræ* aquæ effluentis ab omnibus captæ, præter unum *Polenum*, ad propoſitum noſtrum penitus ſint inutiles. Nam docente viro illo eximio, hæc *Menſura*, cum per tubum exit aqua, longe major eſt quam cum exit ex nudo

fora-

foramine. Et cum foramina in laminis facta pro tubis brevibus habenda ſint, ſaltem niſi laminæ craſſities quamminima ſit reſpectu diametri foraminis, inde factum eſt, ut omnes *Menſuræ* aquæ effluentis ante illum captæ majores veris invenirentur.

Utendum ergo ſolis *Menſuris* a *Poleno* captis. Hæ [a] autem, quæ quidem magno illo foramine 26 linearum captæ fuerunt, ſunt numero decem, nempe ponendo corpus grave cadere in vacuo per pedes Pariſienſes 15, digitum 1, lineas 2, tempore minuti ſecundi, evadit Menſura

| | |
|---|---|
| $1^a$ | $= 2mr^2A\times0{,}5772$ |
| $2^a$ . . . . | 0,5772 |
| $3^a$ . . . . . | 0,5731 |
| $4^a$ . . . . | 0,5710 |
| $5^a$ . . . . . | 0,5690 |
| $6^a$ . . . . | 0.5675 |
| $7^a$ . . . . . | 0,5689 |
| $8^a$ . . . . | 0,5703 |
| $9^a$ . . . . . | 0,5732 |
| $10^a$ . . . . | 0,5613 |
| | 5,7087 |

Quarum omnium intermedia eſt $2mr^2A\times0{,}571$ fere. Hanc itaque habemus pro *Menſura Poleniana* aquæ effluentis, cum vaſis altitudo eſt digitorum 33 *Pariſienſium*, quæ eſt altitudo intermedia inter eas quæ *Poleno* fuerunt uſurpatæ.

*Menſura* autem, quæ ad hanc altitudinem calculo noſtro elicitur ex fundamentali *Mariotti* experimento, quod mox proponemus, eſt $2mr^2A\times0{,}5768$; quæ parte circiter nonageſima octava ſuperat *Menſuram Polenianam*. Tantulum vero diſcrimen oriri potuit vel ex errore centeſimæ partis digiti in æſtimanda diametro

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[a] Polenus de Caſtellis, art. 35, 38, 39, 42, 43. & Epiſtol. ad Marinonium.

metro foraminis; vel ex eo, quod vas excipiens aquam effluentem, centeſima circiter parte majus eſſet quam pro computo *Poleni*; vel partim ex utroque. Adde, quod duplo minus eſt hoc diſcrimen, quam quantum reperitur inter ipſa experimenta *Poleniana*.

3. Supra docuimus inutilia reddidiſſe *Polenum* omnia anteceſſorum experimenta de *Menſura* aquæ effluentis, quod in iis inſtituendis nulla habita fuiſſet ratio craſſitiei laminæ, per cujus foramen aqua efflueret. Unde poſſit aliquis non abſurde ſuſpicari, laborare pari vitio etiam illa experimenta, quibus exploratum fuerat ad quantam altitudinem aquæ ſalirent. Sed dubitationem iſtam altera egregia obſervatione ſuſtulit *Polenus*. Is ſiquidem deprehendit *Menſuram* quidem aquæ longe majorem ex tubo, quam ex nudo foramine effluere; at, quod mireris, quodque nos forſitan, ſi modo Deus vitam & otium conceſſerit, aliquando explicabimus, aquam effluentem per tubos 7 [a] vel 13 lineas Pariſienſes longos, non niſi ad eandem, aut etiam tantillo minorem proſilire diſtantiam horizontalem, quam attingit aqua ex nudo foramine exiliens. Tantillo itaque minor eſt velocitas maxima aquæ poſt exitum e tubo, quam poſt exitum e foramine, cum tubus non admodum brevis eſt: ſed cum tubus eſt breviſſimus, qualis eſt foramen etiam in lamina non admodum tenui, eadem haberi poteſt velocitas maxima aquæ poſt exitum ex hoc tubo, atque poſt exitum ex foramine in lamina tenuiſſima.

Itaque, ad explorandam Theoriæ noſtræ certitudinem, licet æque nobis uti experimentis *Mariotti* de altitudine fontium ſalientium, atque ſi foramina, quibus is uſus eſt, in laminis tenuiſſimis facta fuiſſent.

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[a] Epiſtol. ad Marinonium.

Adſumamus ergo ex ejus experimentis unum aliquod, quod pro fundamento habeatur, ad altitudinem in reliquis experimentis per *Problema* noſtrum XII indagandam.

Is quidem pro experimento fundamentali proponit iſtud, ubi altitudo aquæ in vaſe eſt præciſe pedum 5 *Pariſienſium*. At cum tantillus error, puta duarum linearum, in hoc experimento, errorem ſatis grandem, nempe pluſquam 8 digitorum, gignat in altitudine ſepties majori, quali poſtea utitur *Mariottus*; nos illud experimentum pro fundamentali habere malumus, in quo maxima illa adhibetur altitudo ſepties major priori.

Sit itaque nobis pro fundamento examinis inſtituendi experimentum id *Mariotti*, ubi diameter foraminis eſt linearum *Pariſienſium* 6, & altitudo aquæ in vaſe eſt pedum *Pariſienſium* 34, digitorum $11\frac{1}{2}$, ſive digitorum $419\frac{1}{2}$.

Hanc ille cum altitudinem adhiberet, reperit aquam ex foramine exilientem adſurgere ad altitudinem pedum 31 digitorum 8 vel 9, hoc eſt, ad altitudinem digitorum $380\frac{1}{2}$.

Eſt itaque $A = \overset{\text{dig.}}{419{,}5}$. $a = \overset{\text{dig.}}{380{,}5}$. & $\alpha = 39$ dig.

In altero experimento, ubi $E$, ſeu altitudo aquæ in vaſe eſt pedum 26 digiti 1, ſalit aqua per idem foramen teſte *Mariotto* ad altitudinem pedum 24 digitorum $2\frac{1}{2}$. Prodit vero $e$, ſeu altitudo aquæ ſalientis, per *Corollarium* 1. *Problematis* XII, pedum 24, digitorum 3.

Cæterum, quo melius conferantur altitudines, quas attingere aquam ſalientem deprehendit *Mariottus*, cum altitudinibus iis, ad quas ſalire debuerit ex calculo noſtro, utraſque conjecimus in Tabellam I; ubi vides ita convenire calculo cum obſervatis, ut vix quicquam poſſit ſupra. Cumque capta ſint hæc experimenta eodem foramine diametro ſex linearum, altitudine ſola mutata, vix poteſt dubitari, quin tertia noſtra poſitio, qua *Reſiſtentia, cæteris paribus*, eſt in ratione ſubduplicata altitudinis, recte ſe habeat.

### TABELLA I.

Diameter foraminis 6 linearum.

| Altitudo aquæ in vaſe | | Altitudo ſalientis aquæ | | | |
|---|---|---|---|---|---|
| | | Ex Mariotto | | Ex calculo | |
| ped. | dig. | ped. | dig. | ped. | dig. |
| 34. | 11,5 | 31. | 8,5 | 31. | 8,5 |
| 26. | 1 | 24. | 2,5 | 24. | 3 |
| 24. | 5 | 22. | 10 | 22. | 10 |
| 12. | 4 | 12. | 0 | 11. | 11 |
| 5. | 6 | 5. | 4,75 | 5. | 5 |
| 5. | | 4. | 11 | 4. | 11. 2 lin. |
| 35. | 5 | 32. | 0 | 32. | 1 |

### TABELLA II.

Diameter foraminis 4 linearum.

| ped. | dig. | ped. | dig. | ped. | dig. |
|---|---|---|---|---|---|
| 34. | 11,5 | 30. | 0 | 30. | 0 |
| 24. | 5 | 22. | 8,5 | 21. | 11 |
| 5. | 6 | 5. | 4,7 | 5. | 4,4 |

### TABELLA III.

Diameter foraminis 3 linearum

| ped. dig. | ped. dig. | ped. dig. |
|---|---|---|
| 34. 11,5 | 28. 0 | 28. 0 |
| 26. 1 | 22. | 22. 1 |
| 24. 5 | 22. 2 | 20. 11 |
| 5. 6 | 5. 4,7 | 5. 3,7 |

Cum loco foraminis linearum ſex uteretur *Mariottus* foramine linearum quatuor, reperit aquam proſilientem ex vaſe altitudinis ſupra demonſtratæ, pedum 34 digit. 11 $\frac{1}{2}$, attingere altitudinem pedum 30. Salire debuit per *Corollarium* 2. *Problematis* XII ad pedes 30. digitos 2 $\frac{1}{2}$ fere.

Poſtea cum uteretur foramine linearum trium, aqua proſiliens ex eodem vaſe attigit altitudinem pedum 28. Proſilire debuit per idem *Corollarium* ad pedes 28, digitos 9 circiter.

Sed hæc diſcrimina inter altitudines ex calculo prodeuntes & eas quas obſervavit *Mariottus*, ex parvo errore in capiendis foraminum tantulorum diametris oriri potuerunt.

Nam ſi radius maximi foraminis, quem lineis tribus æqualem ſtatuit *Mariottus*, tres lineas ſuperaverit parte $\frac{1}{100}$ digiti *Pariſienſis*; vel ſi radius ſecundi foraminis, quem lineis duabus æqualem facit *Mariottus*, parte $\frac{1}{116}$ digiti *Pariſienſis* a duabus lineis defecerit; in alterutro caſu ſaliet aqua per calculum ad altitudinem 30 pedum, prorſus uti obſervavit *Mariottus*.

Item, ſi radius minimi foraminis, parte $\frac{1}{100}$ digiti *Pariſienſis* minor fuerit linea 1 $\frac{1}{2}$; & ſimul radius maximi foraminis parte $\frac{1}{100}$ digiti ſuperet tres lineas;

dabit calculus altitudinem aquæ ſalientis pedum $28\frac{1}{2}$, quantam deprehendit *Mariottus*.

Calculo autem ad hunc modum correcto, exhibent Tabellæ $2^a$ & $3^a$ altitudines *Mariotti* cum calculo noſtro collatas.

Hic autem notandum eſt, in Tabella II. altitudinem ſalientis ex vaſe alto pedes 24. digitos 5. *Mariotto* obſervatam, nempe altitudinem pedum 22. dig. $8\frac{1}{2}$, item in Tab. III. altitudinem ſalientis ex eodem vaſe, nempe altitudinem ped. 22. digit. 2. altitudines, quas exhibet calculus noſter, magno intervallo ſuperare.

Sed corruptos eſſe *Mariotti* numeros ſatis conſtat. Nam,

1. Regula *Mariottiana* ſupratradita, cui ſatis bene convenire cum obſervatis ipſe teſtatur, numeros multo minores, & ſatis ad calculum noſtrum accedentes exhibet.

2. Fieri omnino nequit, ut aqua ſaliens ex foramine 4 linearum attingat altitudinem ped. 22. dig. $8\frac{1}{2}$; neque ut aqua ſaliens ex foramine trium linearum attingat altitudinem pedum 22. dig. 2; ſi quidem aqua ſaliens ex foramine 6 linearum non attingat niſi altitudinem ped. 22. dig. 10. quod ex analogia obſervationum *Mariotti* facile patebit.

3. Si vera ſit altitudo ped. 22. dig. 2. in Tab. III. ſalit aqua erumpens ex vaſe alto ped. 24. dig. 5. ad majorem altitudinem, quam ubi erumpit ex vaſe alto ped. 26. dig. 1. quod manifeſte abſurdum eſt.

His cauſis adducor ut credam *Mariottum*, ubi de priori ex his experimentis verba faceret, in adverſariis ſuis ſcriptum reliquiſſe, *Le jet de quatre lignes n' a eté plus bas que* d' onze pouces ou onze pouces &

demi, *que celui dont l'ajutage etoit de ſix lignes*; unde tranſcripſerit *De la Hirius*, *plus bas que* d'un pouce ou un pouce & demi. Facta autem hac correctione erit altitudo *Mariotto* obſervata 21 pedum, & digitorum 11. vel 10$\frac{1}{2}$, quæ cum calculo noſtro adamuſſim convenit.

In ſecundo experimento, cum erumpit aqua ex foramine tres lineas amplo, patet ex analogia ſalire aquam debere ad altitudinem duobus circiter pedibus minorem, quam ubi erumpit ex foramine ſex linearum. Forte, loco verborum *celui de trois lignes a eté plus bas que celui de ſix lignes* de pres de 8 pouces, ſcriptum fuerat *Mariotto*, plus bas que celui de ſix lignes *d'un pied & 8 pouces*, quod non longè diſtat a calculo noſtro.

Id vero mirum non videbitur, ejuſmodi errata contingere potuiſſe, ſi animadverteris ipſum Cl. *De la Hirium*, qui, poſt obitum *Mariotti*, ejus chartas imprimendas curaverit, in præfatione huic operi præfixa hæc habere. *La moitié de cet ouvrage etoit aſſez au net pour etre imprimeé: mais le reſte m' a donné beaucoup de peine à raſſembler ſur les Memoires qui m'en ont eté mis entre les mains apres ſa mort.*

Cæterum, omnibus perpenſis, adeo bene convenit calculo noſtro cum experimentis clariſſimi hujus & diligentiſſimi obſervatoris, ut etiam cum *Menſura Poleniana* aquæ effluentis, cumque menſuris diametri venæ contractæ *Newtono* & *Poleno* captis, ut vix dubitandum ſit quin aut vera, aut vero quamproxima ſit ſupra expoſita theoria.

Hæc autem facile extenditur ad aquam effluentem per foramen quadratum, aut rectangulare quodvis,

vel etiam ad foramen annulare, quale ambit circellum Newtonianum Corollariis ultimis *Prop.* XXXVI. *Libr.* II. *Princip.* adhibitum, unde in Reſiſtentia fluidorum continuorum ex hujus circelli contemplatione deducta plura videntur mutanda; quod in anteceſſum eruditos monere viſum eſt, quo eos ad accuratius præcedentium examen excitarem.

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## II. *A Collection of the* Obſervations *of the* Eclipſe *of the* Sun, Auguſt 4th 1738. *which were ſent to the* Royal Society.

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### 1. *An* Eclipſe *of the* Sun, *obſerved* Auguſt *the* 4th 1738. *by Mr.* George Graham *and Mr.* Short, *FF. R. S. at Mr.* Graham's *Houſe in* Fleetſtreet, London, *by a Refracting Teleſcope of* 12 *Feet* Focus, *armed with a Micrometer, and by a reflecting Teleſcope of nine Inches focal Length.*

| | h. | ' | " | |
|---|---|---|---|---|
| Beginning of the Eclipſe at | 9. | 59. | 20 | A. M. |
| End at . . . . . . . . | 11. | 59. | 36 | |
| | dig. | min. | | |
| Quantity of Obſcuration by the Micrometer . . | 3. | 28. | | |
| | h. | ' | " | |
| Duration . . . . . . . . . . | 2. | 0. | 16 | |

*N. B.* The Perſon who was obſerving the Tranſit of the Sun over the Meridian, obſerved the End to be at the ſame Inſtant with the above Obſervation.

2. *Eclipſis* Solis, *Tubo 7 ped. Micrometro D.* Grahami *inſtructo, d.* 4 Aug. *paulo poſt meridiem* 1738. Upſaliæ *obſervata à Dno.* Andrea Celſio, *R. S.* Lond. *S. & R. S.* Succ. *Secr.*

| Temp. ver. | | | | | |
|---|---|---|---|---|---|
| h. | ′ | ″ | | | |
| 12. | 18. | 52 | Initium eclipſeos. | | |
| 12. | 35. | 57 | Dig. eccl. | 0. | 5 $\frac{1}{2}$ |
| 12. | 37. | 47 | | 0. | 3 $\frac{1}{5}$ |
| 12. | 42. | 22 | Finis. | | |
| 0. | 23. | 30 | Duratio. | | |

Propter nubes per vices ſolem obtegentes maximam obſcurationem & ceteras eclipſeos phaſes obſervare non licuit; maximum tamen ſolis defectum dig. 0. 8′ h. 12. 30′ 37″ accidiſſe ex hiſce obſervatis deducitur.

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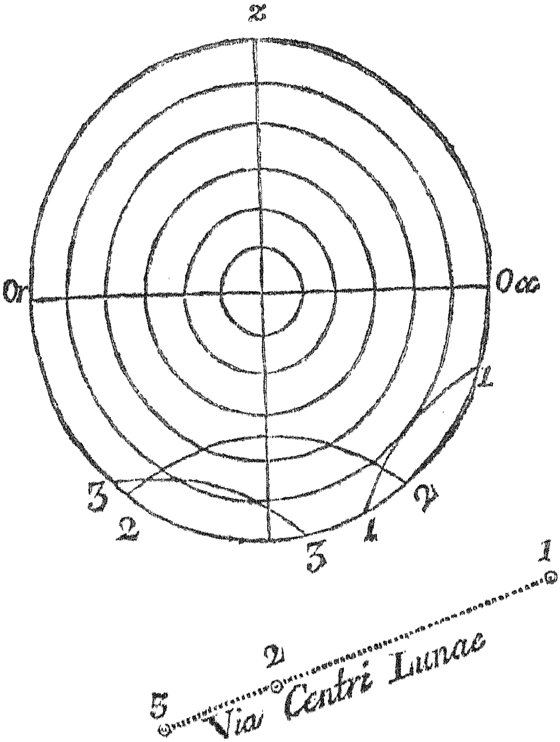
3. *Tres* Phaſes *Eclipſeos* Solis *partialis* Vitembergæ *die* xv. Auguſti *St. N.* iv. *St. Vet. anno* CIↃ.IↃCC.XXXVIII. *à* Jo. Frid. Weidlero, *R. S.* Lond. *Sodal. obſervatæ.*

ETſi propter nubes, quibus tum cœlum involvebatur, nec initium, nec finis deliquii ſpectari potuerit, apparuerunt tamen, diſtractis ſubinde venti impetu nubibus, Phaſes ſequentes;



| Hor. | Min. | |
|---|---|---|
| 11. | 30. | Notata eſt phaſis prima deliquii creſcentis, 1 digit. |
| 12. | 19. | *p. m.* viſa eſt phaſis altera 2 digit. 30 Minutorum. |
| 12. | 37. | Apparuit phaſis decreſcentis eclipſis tertia. |

Spectatæ etiam ſunt eodem tempore maculæ in diſco Solis decem.

Ceterum Lunæ diſcus ſub Sole, peripheriam accurate terminatam, abſque ulla inæqualitate, necnon faciem nigerrimam oſtendit. Nullum quoque Atmoſphæræ orbi Lunæ inſidentis veſtigium potuit deprehendi.

Aberravit calculus, ex Tabulis *Ludovicianis* deductus, quoad magnitudinem & tempus ſummæ Eclipſeos. Magnitudo enim prædicebatur 2 digitorum, 20 minutorum; Medium h. 12. m. 5.

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### 4. Defectus Solis, *obſervatus e ſpecula* Bononienſis *Scientiarum Inſtituti die* 15 Auguſti M.DCC.XXXVIII. *mane, referente* Euſtachio Manfredio *ejuſdem inſtituti Aſtronomo, & R. S.* Lond. *S.*

CUM Solis diſcus per hoſce dies maculis pluribus ſcateret, ipſo mane inſtantis Eclipſeos circiter horam 21. 30 poſt meridiem, *Euſtachius Zanottus, Phil. Doct. Math. Profeſſor publicus, Collega meus*, ope micrometri aptati tubo pedum 8, præcipuarum poſitum inveſtigavit, quæ præſertim Auſtralem Solis partem, (qua parte Luna ſubitura erat) obſidebant; omnes enim deſcribi neque ad rem attinebat, neque per ſpectatorum turbas licuit. Eas maculas, quarum loca definire potuit, ſubjectum ſchema exhibet.

Initium deliquii non perſenſi ante horam 22. 52. 25 poſt meridiem, licet & ego tubo pedum undecim, & alii tubis aliis Solis margines diu perluſtrâſſent. Opinor tamen ipſum Luminarium contactum minuto ſaltem maturius accidiſſe, quam animadverterim; quod ipſum a ſuccedentibus phaſibus confirmari videtur.

Digiti Ecliptici per circulos in tabella de more exaratos, digitorum vero partes æſtimatione definitæ ſunt. Teleſcopium erat pedum 6. Imago unciarum 2, aut circiter. Phaſes emerſionis phaſibus immerſionis certiores ſunt multis de cauſis.

Immerſionis phaſes.

| Temp. ver. h | ′ | ″ | |
|---|---|---|---|
| 23. | 0. | 10 | Defectus unius digiti |
| | 11. | 20 | dig. 2 |
| | 23. | 56 | dig. 3 |
| | 35. | 14 | dig. 4 dub. |
| | 45. | 14 | dig. $4\frac{1}{3}$ |
| | 47. | 6 | dig. $4\frac{1}{2}$ |
| | 51. | 14 | dig. $4\frac{3}{5}$ |
| | 55. | 14 | dig. $4\frac{2}{3}$ |
| | 58. | 14 | dig. $4\frac{3}{4}$ |
| 0. | 1. | 46 | dig. $4\frac{4}{5}$ |

Emerſionis phaſes.

| Temp. ver. h | ′ | ″ | |
|---|---|---|---|
| 0. | 4. | 14 | adhuc dig. $4\frac{4}{5}$ |
| | 18. | 5 | dig. $4\frac{1}{2}$ |
| | 22. | 43 | dig. $4\frac{1}{3}$ |
| | 31. | 50 | dig. 4 |
| | 39. | 13 | dig. $3\frac{1}{2}$ |
| | 46. | 50 | dig. 3 |
| | 52. | 55 | dig. $2\frac{1}{2}$ |
| | 57. | 31 | dig. 2 |
| 1. | 3. | 26 | dig. $1\frac{1}{2}$ |
| | 7. | 52 | dig. 1 |
| 1. | 13. | 4 | ſemidigitus |

Finis Eclipſeos Tubo pedum undecim . . . . } hor. 1. 18. 1

Tubo pedum octo hor. 1. 18. 2

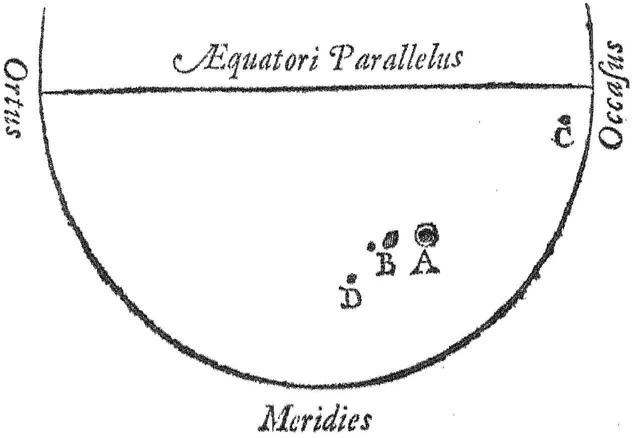
Interea maculæ Solis a Luna obtectæ ac retectæ notabantur in hunc modum.

| Temp. ver. h | ′ | ″ | |
|---|---|---|---|
| 23. | 3. | 50 | Macula *C* Lunam ſubit, tubo pedum 8. |
| | 21. | 3 | Macula *A* deliteſcere incipit, tubo pedum undecim. |
| | 21. | 49 | Maculæ *A* centrum occultatur. |
| | 22. | 41 | Tota ſub Luna immergitur. |
| | 23. | 54 | Duarum Macularum ad *B* prior immergi incipit. |
| | 25. | 10 | Ejuſdem Maculæ centrum latet. |
| | 25. | 45 | Tota abſconditur. |
| | 26. | 24 | Duarum ad *B* poſterior centro ſuo Lunæ marginem ſubit. Hactenus eodem teleſcopio pedum undecim. |
| | 27. | 2 | Macula *D* abſcondi incipit tubo pedum 8. |
| 23. | 31. | 2 | Tota deliteſcit eodem tubo. |
| 0. | 31. | 45 | Macula *A* apparere incipit in ſpecie Solis per tabellam excepta. |
| | 32. | 30 | Eadem macula tota cum areola ſua emerſerat tubo pedum undecim. |
| | 33. | 25. | Emerſio centri prioris duarum ad *B* eodem tubo. |
| | 34. | 59 | Totalis emerſio ejuſdem Maculæ eodem tubo. |
| | 35. | 51. | Poſterior duarum ad *B* tota emerſerat, tubo eodem. |

Obſervationes tam macularum, quam digitorum eclipticorum habuerunt (præter *Zanottum*) *Franciſcus Vandellius Mutinenſis Inſtit. Scient. Profeſſor,* *Thomas Perellus Florentinus, M. D. Joſeph. Roverſius, Petronius Matheucius, Jo. Andreas Boldrinus Placentinus, Salvator Oliva Mediolanenſis,* atque alii. Omnes ex eodem horologio tempora notârunt, quæ poſtmodum à meridianis obſervationibus correcta conſignavimus.

Vigente Eclipſi obſervavi tranſitum Lunæ ac Solis per planum ſemicirculi muralis juxta meridianum ſuſpenſi.

Ad definiendum Lunæ tranſitum, tempus notavi, quo ſegmentum perexiguum e diſco Lunæ in Sole conſpicuo filo horizontali teleſcopii ſubtenſum, a verticali filo biſſectum apparuit : tunc enim oportet ipſum Lunæ centrum in verticali extitiſſe. Tranſiit autem centrum Lunæ ante centrum Solis ſecundis horariis 34. hoc eſt hora 23. 59. 26 poſt meridiem diei 14. Altitudo Meridiana limbi borei Lunæ grad. 59. 36. 15; limbi borei Solis 59. 53. 0.



III. Some

## III. *Some* Electrical Experiments, *chiefly regarding the* Repulſive Force *of Electrical Bodies; communicated in a Letter from* Granvile Wheler, *Eſq;* F. R. S. *to* Cromwell Mortimer, *M. D.* R. S. *Secr.*

*S I R,*

THE following Experiments I made in the Autumn of the Year 1732. and repeated them to Mr. *Grey* the following Summer, when he came into the Country. I had then Thoughts of communicating them to you through his Hands, to whom they owe their Being, and drew them up with a Letter to him prefixed: But, unwilling to be an Author, I deferred the Communication from time to time, till the ſecond Summer came, when I was informed, that Mr. *Dufay* had written a Letter to his Grace the Duke of *Richmond*, dated *Dec.* 27. 1733.[*] wherein he takes Notice of the ſame Solution of the Repulſive Force, a Copy of which Letter I received the *September* following, incloſed in one from Mr. *Grey*. All Thoughts of publiſhing them were then laid aſide, but meeting ſome time ſince with a fuller Account of them in the Memoirs of the Academy of Sciences for the Year 1733. by which it appeared Mr. *Dufay*'s Experiments were not the ſame with my own, and having ſince received the Commands of our worthy Preſident to communicate them, I take the Liberty at laſt of ſending them to you, as I intended they ſhould have paſſed through Mr. *Grey*'s

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[*] *Philoſophical Tranſactions*, N° 431. p. 258.

Hands, if Mr. *Dufay* had not appeared upon the ſame Subject, in three Propoſitions, and a few Corollaries. I am, Sir, with a very great Regard,

*Otteſden-Place,*
*Jan.* 17. 1737-8.

*Your much obliged,*
*humble Servant,*

Granv. Wheler.

## PROPOSITION I.

*Bodies made Electrical, by communicating with an Electrical Body excited by Friction, are in a State of Repulſion with regard to ſuch excited Bodies.*

### EXPERIMENT I.

I hung a fine white Thread by a Loop, to an horizontal blue Silk Line, about four Feet long, tied at each End, and at about a Foot diſtance from it, placed a Glaſs Tube two Feet and a half long nearly, and one Inch and quarter Diameter, fixed in the Centre of a circular Piece of Wood ſupported upon three braſs Skrews, ſo that the Tube and pendulous Thread were parallel to each other. The Tube being rubbed, the Thread was attracted and repelled Seven or Eight times (in very good Weather, I have obſerved it move to and from the Tube Twelve times, at above one Foot Diſtance). I then tied a Piece of new ſmooth Packthread to the Top of the Tube, and to the Loop of the Thread hanging down as before, and again excited the Tube: The Thread, without coming once towards the Tube, went into and continued

tinued in a State of Repulſion; but if I only touched the communicating Packthread with my Finger, the white Thread immediately haſtened to the Tube: And upon hanging another long Piece of Packthread, which reached the Ground, to the communicating Packthread, and again rubbing the Tube, the pendulous white Thread was ſo far from going into a State of Repulſion, that it became attracted to the Tube, and continued ſo, without ſhewing the leaſt Tendency to a State of Repulſion, as long as the Virtue of the Tube laſted.

### EXPERIMENT II.

I tied a Piece of ſmall Cane about ſixteen Inches long, and one fourth of an Inch Diameter at one End, and a little more at the other, at right Angles to the Top of my Tube, fixed in the ſame Pedeſtal as before, and making unequal Arms with it; and at the End of the larger Arm, a Piece of Stick traverſly, about ſix Inches long, ſo as it might ſlide backwards and forwards to and from the Tube: This moveable ſhort Stick at one End ſupported a very fine white Thread, at the other a very fine blue Silk, by which means we had now a Silk and a Thread at the ſame time hanging parallel to the Tube. The Thread, after the Tube was rubbed, firſt was attracted, but then immediately repelled, and continued a conſiderable time in a State of Repulſion; but upon tying to the End of the ſhorter Arm of Cane, a Piece of long Packthread, which reached down upon the Table, and rubbing the Tube again, the Thread continued in a State of Attraction, without being once repelled during the whole Virtue of the Tube, as in the preceding Experiment. Yet the Silk, whether the long Packthread was added or not to the ſhorter Arm of the Cane, continued conſtantly attracted towards the Tube; but upon putting a ſhort Silk only ſix Inches long, in the ſame Circumſtances, it would, after ſome time rubbing the Tube, turn into a State of Repulſion, the upper Part firſt bending from the Tube, and the lower Part towards it, the upper Bending ſtill increaſing till the Whole was repelled; and, which is remarkable, the upper Part or Bending, upon the Approach of the Finger, or any Body not impregnated with Electrical *Effluvia*, flying towards it, and the under Part or Bending rather ſeeming to fly from it, till the Whole was ſaturated, and in a State of Repulſion with regard to the Tube, and then any Part of it would come to the Finger, or any other Body, not made Electrical. It is proper to add here one more Difference remarkable between the Thread and Silk: The Thread in a State of Repulſion touched with the Finger, would immediately fly towards the Tube; but the Silk in the ſame State, after touching ſeveral times, ſtill continued in a State of Repulſion, and would not be attracted till ſqueezed from Top to Bottom between the Finger and Thumb, once, and ſometimes two or three times. And farther, the Thread would immediately turn again into a State of Repulſion, whereas the Silk, after the Violence committed by the Thumb and Finger, being attracted to the Tube, would not without a good deal of rubbing the Tube, be repelled again.

*N. B.* The Silk was untwiſted, and about one fourth part of the Thickneſs made uſe of.

## COROLLARY I.

From the different State of the pendulous Silk and Threads at the ſame time under the ſame Circumſtances, the former being attracted while the latter is repelled, it follows, that a mere Vibration of the Parts of the Tube is not ſufficient to account for the Electrical *Phænomena*; which appears farther from the two contrary States continuing ſome time, and from the ſame Piece of Silk being at once part in a State of Repulſion, part in a State of Attraction.

## COROLLARY II.

That ſome Bodies immediately receive and immediately part with the Electric *Effluvia*, but that others are ſome time before they receive it, or receive enough of it; and when they have received enough of it, part with it more unwillingly.

## COROLLARY III.

That any light Body, as a Feather, after touching or nearly approaching the Tube, muſt fly from it: Upon Contact or a near Approach, it ſaturates itſelf with the Electric *Effluvia*, and by this means becomes itſelf Electrical (as is plain from its coming to all other Bodies too large to come to it); and conſequently, from the foregoing Experiments, is in a State of Repulſion with regard to the Tube. As ſoon as it touches any other Body, it loſes its acquired Electricity, and therefore may be attracted as at firſt.

## PROPOSITION II.

*Two or more Bodies made electrical by communicating with an Electrical Body, excited by Friction, are in a State of Repulſion with regard to one another; or Bodies made electrical by Communication, repel one another.*

### EXPERIMENT I.

I ſuſpended two Pieces of white Thread, each about one Foot long, by Loops, upon an horizontal blue ſilk Line four Feet long, about half an Inch aſunder from each other; and upon holding the excited Tube over them at a little Diſtance, the two Threads immediately receded from each other conſiderably at the Bottom. I then removed one of the Threads, and held the Tube over the other, in the ſame manner as before. The ſingle Thread was not obſerved to move to either Side; conſequently the moving of the Threads ſide-ways was occaſioned neither by the Attraction of the croſs Line, nor that of the Tube, nor by the Frame of Wood, to which the croſs Line was tied at each End, but only by their Action upon each other.

I then added a third String, at the ſame Diſtance from the ſecond, that the ſecond was from the firſt, and upon holding the excited Tube over the middle one, at the ſame Diſtance from the croſs Silk I did before, if the Strings continued in the ſame Plane, the middle one ſtood ſtill, and the String on each ſide of it receded conſiderably at the bottom Part, which in this Caſe muſt neceſſarily happen upon a

Suppoſition, that they repel one another equally; for the two contrary Forces of the outer Threads deſtroy each other, and conſequently the middle one muſt remain quiet; but there was nothing to hinder the middle one from repelling the two outer on each hand ſideways. If, as it often happened, the three pendulous Threads did not remain in the ſame Plane, they then all receded from one another equally, and formed nearly a triangular Priſm; the three Threads being the three Edges, or rather a triangular Pyramid with the Top cut off.

Upon ſuſpending four Threads at the ſame Diſtance as before from one another, if they continued in the ſame Plane, they all parted, but the two outermoſt more from their Neighbours, than the two in the middle from each other.

If they moved out of the Plane they were firſt in, they formed two Priſms, each extreme with the two in the middle forming one, or rather a Parallelopepid, leſs at Top than at Bottom.

When five Strings were ſuſpended, either the middlemoſt continued Stationary when the Plane was not altered, or if it was, they formed three Priſms.

## EXPERIMENT II.

I afterwards placed two croſs blue Silks, of the ſame Length as before, about half an Inch aſunder from one another horizontally, and tied at each End; and upon each of theſe, at different times, hung two, three, four, and five Threads, at the ſame Diſtances as before, when every thing ſucceeded, as it ought to have done, upon a Suppoſition of their mutually repelling one another.

### EXPERIMENT III.

To each of the Ends of two Threads, ſuſpended as at firſt, a Feather being tied, the two Feathers manifeſtly receded from each other: And when three Threads had each a Feather at their Extremities, the middlemoſt became Stationary, and the two outer went off on each hand.

### EXPERIMENT IV.

I ſuſpended afterwards two, three, four and five blue ſilk Strings by Loops, upon one croſs blue Silk, and found the ſeveral Experiments ſucceed in the ſame manner as in Threads; except that they remained a longer time before they appeared in a State of Repulſion, receded from one another more ſlowly, and continued much longer in the repulſive State, after the Tube was removed.

### EXPERIMENT V.

This done, I made ſeveral Experiments, by mixing Silks of different Colours, and Silks and Threads of different Colours, and ſuſpended them by Turns upon Silks of different Colours, whence aroſe ſeveral different *Phænomena*, which I ſhall not take Notice of here; but I muſt not omit mentioning, that upon ſuſpending two black Silks at the before-mentioned Diſtances from each other, upon a ſcarlet croſs Silk, they did not only open and recede from each other at the Bottom conſiderably, but when the Tube was held under, ran or jump'd away from each other, to the very Ends of the croſs red Silk that ſupported them, taking two, three, or more Jumps from each other.

I obſerved the ſame of two white Silks ſuſpended upon red Silk, but think they did not move away ſo briskly as the Black.

## EXPERIMENT VI.

I tried whether Threads hanging parallel, as above, from a croſs blue ſilk Line, and joined with one or more tranſverſe Threads, ſo that the perpendicular Threads remained nearly parallel, would mutually repel when the Tube was held over them; they ſeemed to repel each other full as ſtrongly as before. When they were joined by only one croſs Thread towards the Top, the lower Parts ſeparated conſiderably; when joined by two croſs Threads, one towards the Top, and one towards the Bottom, they ſeparated both in the middle Parts between the two croſs Threads, and at their lower Ends under the ſecond or loweſt croſs Thread. When ſeveral were tied together at the Top and Bottom, and about a Foot long, not by tranſverſe Threads, but in a Knot at each End, they all bellied out from one another, deſcribing a Figure generated by an Ellipſis, revolved about its greater Axis; approaching nearer to a Sphere, the ſtronger the repulſive Force was. And, though it was only a neceſſary Conſequence, I could not without ſome Pleaſure obſerve the Knot at the Bottom, as the Strings ſwelled out, ſenſibly riſing up. I could ſcarce forbear imagining my Bundle of Silks, a Bundle of muſcular Fibres.

## EXPERIMENT VII.

I ſuſpended two braſs and afterwards two iron Wires upon a croſs blue Silk, in the ſame manner as the Threads and Silks before-mentioned, and found the Experiments ſucceed as in Threads of the ſame Number, except that they did not recede ſo far from one another, which muſt neceſſarily follow from their greater Weight.

*N. B.* Theſe Experiments were made ſometimes with the Tube held over, ſometimes held under the croſs Line; but they generally ſucceeded beſt when the Tube was held under the Extremities of the pendulous Wires, which in this Caſe ſeparated much farther, and kept their repulſive Force much longer.

## EXPERIMENT VIII.

I muſt not omit here, that I hung up two Fragments of Barometer Tubes, each about a Foot long, by blue ſilk Lines going through each, ſo that they hung parallel, horizontal, at equal Heights, and about one quarter of an Inch aſunder; upon holding the excited Tube above and under them, they manifeſtly receded from each other.

I ſuſpended the ſame Fragments of Tubes by blue ſilk Lines of equal Length, from a croſs blue Silk in a perpendicular Poſture, each having a little red Sealing-wax at the upper End, to hinder the Strings from ſlipping off: The excited Tube being brought near them, they receded manifeſtly, eſpecially at the lower Ends; the Diſtance from one another, when at Reſt, being about a quarter of an Inch.

## COROLLARY I.

From the repulſive State of the pendulous Threads tied tranſverſly with two or more Threads, and bending out from each other, where at Liberty, it follows that all the Threads of a Table-cloth, or other large Piece of Linen, when made Electrical, (as has been often done all over) have a Deſire to fly from each other; and conſequently, was the repulſive Force ſtrong enough, the Whole would be diſſolved, or torn in Pieces. A ſhort Thread of black Silk, by repeated Applications of the Tube, I have ſeparated into its ſmalleſt Fibres: Whence is ſuggeſted more plainly, than from any other known Experiment, a Reaſon for the Diſſolution of Bodies in their reſpective Menſtruums, *viz.* That the Particles of the Solvend having imbibed the Particles of the Menſtruum, ſo as to be ſaturated with them, the ſaturated Particles become repulſive of each other, ſeparate, and fly to Pieces.

And hence, perhaps, ariſes a Reaſon, why Particles of Bodies ſpecifically heavier than the Menſtruums in which they are diſſolved, are, after the Diſſolution and Diſperſion, ſuſpended all over the Menſtruum, *viz.* That they repel each other. Attraction is inſufficient; for Parts attracted equally in all Directions, are, in Effect, not attracted at all, and the Imperfection of the Fluid will not do; for if this occaſioned the Suſpenſion, ſtriking or jogling the Veſſel would make them ſubſide.

## COROLLARY II.

Hence we plainly ſee how Heat may divide the Particles of Water with greater or leſs Force, in Proportion to the Degree of Saturation, and throw them into the Air; where they may continue to aſcend, if at the ſame time they are divided, they are expanded into little Shells or Bubbles, of a Diameter large enough to be ſpecifically lighter than the lower Air, as the great *Halley* has ſagaciouſly conjectured. Or if the upper Parts of the Air, as being leſs ſaturated than the lower Parts, may be able to draw them upwards, till the Exceſs of Weight, which is conſtantly increaſing, is equal to the Exceſs of Attraction.

## PROPOSITION III.

*Bodies, made Electrical by rubbing, do themſelves repel one another, or the electrical excited Bodies themſelves repel one another.*

### EXPERIMENT I.

The two Fragments of Tubes before-mentioned *, being ſuſpended horizontally, and in a Poſture parallel to each other, I held in one Hand, and with the other rubbed ſome time; then gently letting them go ſo as to be at Reſt, I could plainly perceive them recede from each other towards that End which had not been taken hold of.

But as upon repeated Trials I found it difficult to make this Experiment ſucceed unexceptionably, the Tubes generally having ſome reciprocating Motion of their own, after quitting the Hand, I made uſe of the following Method.

I ſuſpended a ſingle little Tube about a Foot long, by a long blue ſilk Line, perpendicularly, and upon a Table placed my great Tube fixed in a Stand as before, excited each alternately, two or three times;

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* Prop. II. Exper. VIII.

then gently moved the Tube with the Stand it was fixed in, near the ſuſpended little one: The little Tube manifeſtly receded ſo much, that a croſs blue ſilk Line ſtretched horizontally at about an Inch Diſtance on the oppoſite Side, would ſometimes, upon the firſt Approach of the great Tube, be touched by it.

### EXPERIMENT II.

Three ſcarlet Silks, pendulous each by Loops from a croſs ſilk Line, and cloſe together, being rubbed downwards two or three times, between the Finger and Thumb, ſhewed a conſiderable repulſive Force with regard to each other, forming themſelves immediately into a triangular Pyramid, and continuing in this State of Separation ſome time, and which ſhews their Attraction at the ſame time, with regard to other Bodies not excited, coming to them when brought near them.

I obſerved the ſame repulſive Force in three yellow and three green Silks, under the ſame Circumſtances, and excited in the ſame manner, but not in ſo great a Degree as in Scarlet. In Blue the repulſive Force was ſcarce diſcernible after ſeveral times rubbing.

### SCHOLIUM.

The Rev$^{d}$ Dr. *Stephen Hales*, in his 12th Article of his 13th Experiment, in his ſecond Volume of *Statical Eſſays*, obſerves, "That if a Piece of one "of the *Bronchiæ* or Gills of the *Muſcle-Shell-Fiſh*, be "cut off, and put into a ſmall concave Glaſs, with "three or four Drops of its Liquor, and be then "placed under a double Microſcope, the Blood may

"be ſeen greatly agitated in the fine Veſſels; and at
"the cut Edge of the Piece of Gill, may with great
"Pleaſure be ſeen many Blood-globules, repelled
"from the cut Orifices of the Blood-veſſels, and
"attracted by other adjoining Veſſels; alſo other
"Globules rolling round their Centre, and repelling
"each other; whence (as he ſays) it is plain, that
"Bodies, by briſk rubbing and twirling about, may
"acquire, in a watry Fluid, both attractive and repulſive Virtue or Electricity."

From our laſt Experiments we are led to think, that the Globules of the Blood, if by Friction they acquire an electrical attractive Virtue, muſt of neceſſity repel one another; and that Electricity is not ſo properly called an attractive and repulſive Virtue, as a Virtue attractive of thoſe Bodies that are not attractive themſelves, and repulſive of thoſe that are; and that this repulſive Force of the electrical Blood-globules, excited by Friction, as they flow in their Chanels (and particularly in the ſmall ones, and perhaps more ſo in thoſe of the Lungs, where the refrigerating Power of the Air may aſſiſt, as Dr. *Hales* has obſerved); this repulſive Force of the Blood-globules, I ſay, may be the great Cauſe that hinders the Blood from coagulating as it circulates; may be the great Cauſe of the conſtant Perſpiration in an healthy State, and of the Increaſe of it, *cæteris paribus*, in Proportion as the Velocity and Friction of the Blood increaſes.

If theſe things are ſo, the Neceſſity of Exerciſe appears more plainly than ever, in order to keep the Body in an healthy State, as we may obſerve here the very Steps that Nature makes uſe of to free herſelf from her Suppreſſions. *Granv. Wheler.*

# III. *An Account of ſome of the* Electrical Experiments *made by* Granvile Wheler, *Eſq;* *at the* Royal Society's *Houſe, on* May 11. 1737. *drawn up by* C. Mortimer, *M. D.* R. S. *Secr.*

## EXPERIMENT I.

A Large Octavo Book was placed horizontally upon ſilk Lines, and the upper Surface ſtrewed with ſeveral Pieces of leaf Braſs, all or the greateſt Part of which flew upwards, from one another, and off the Book, upon holding an excited Tube at a little Diſtance underneath the Book.

## EXPERIMENT II.

Two Lines were extended horizontally the whole Length of the Library being between 30 and 40 Feet, diſtant from one another about two Feet at one End, and meeting together in a Knot at their other Ends, the whole Lines being Packthread, except five Feet of ſilk Line tied at each of the ſeparated Extremities, as well as at the Knot where the other Ends united, in order to ſtop the Current of the *Effluvia*. Upon the united Extremities was placed horizontally a Piece of Card about two Inches ſquare, on which were ſtrewed Pieces of leaf Braſs: The excited Tube being held at a little Diſtance under the ſeparated Extremities of the Packthread, the leaf Braſs on the Card at the other End flew upwards, and off the Card.

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## EXPERIMENT III.

Five glaſs Receivers placed one within another upon an electrical Cement of Bees-wax and *Venice* Turpentine, were all exhauſted: In the innermoſt a fine white Thread about five Inches long, was ſuſpended from the Crown of it, by the Aſſiſtance of a little Cement made of Bees-wax and Oil. Upon moving the excited Tube up and down near the Side of, and horizontally to and from the outward Receiver, the ſuſpended Thread manifeſtly made many Vibrations correſponding to the Motions of the Tube.

## EXPERIMENT IV.

An electrical circular Cake of Bees-wax and Roſin, ten Inches in Diameter, was placed horizontally upon a tall glaſs Receiver near three Feet high, ſuch as is made uſe of for the dropping the Feather and Guinea. This Cake being, the preceding Evening about Eight o'Clock, warmed with an hot Iron held over it, and then ſtruck perpendicularly all over its Surface with the Hands in parallel Directions, and ſo left cover'd with a thin Paſteboard, was about Twelve o'Clock next Day at Noon gently uncover'd, and an ivory Ball about one Inch and half Diameter placed in the Centre, a fine white Thread about ten Inches long, with a ſmall Piece of Cork, the Size of a Pin's Head, at the End of it, being held between the Finger and Thumb, was gently let down upon the Vertex of the Ball; it firſt flew off at ſome Diſtance, and then made ſeveral pretty regular Revolutions from Weſt to Eaſt about it, in the Form of a Circle.

### EXPERIMENT V.

The Ball was removed, and the Cake again warmed and excited as before; after which the Ball was replaced at a little Diſtance from the Centre, nearer to Mr. *Wheler*; the Conſequence of which was, that the pendulous little Body moved with a direct Motion as before, but in an Orbit that reſembled an Ellipſe, having the Ball in one of its *Foci*.

### EXPERIMENT VI.

Two Bullets fixed on little Stands of Cork about one quarter of an Inch high, were placed upon the Cake, each about an Inch diſtant from the Centre of it, and in a Line with the Centre and Mr. *Wheler*; the pendulous Body deſcribed an Orbit reſembling an Ellipſe, having the two Bullets for its *Foci*, and the Motion was direct from Weſt to Eaſt.

### EXPERIMENT VII.

Inſtead of the Cork, another pendulous Body of a cylindrical Form was made uſe of, tied to a fine white Thread about twenty Inches long; the Cylinder conſiſted of two circular Baſes of Paper half an Inch Diameter, but all cut away except a Ring and a ſmall Bar croſs the Middle, through which Baſis ſix equal fine Threads paſſed at equal Diſtances from one another, knotted at the lower Baſe ſeparately, and joined together in one Knot at about half an Inch Diſtance from the upper Baſe, from which Knot proceeded the long Thread. This Body moved from Weſt to Eaſt about the central Ball, and at the ſame time diſcover'd a Motion about its own Axis in the ſame Direction; but after two or three Turns generally ſtopt, and turn'd the contrary Way, which ſeem'd to ariſe from the untwiſting of the Thread.

### EXPERIMENT VIII.

A Thread about a Foot long, was ſuſpended from an horizontal Line of Packthread, parallel to it an excited Tube placed erect in a Stand, the Thread approached the Tube, and continued in a State of Attraction: A Thread of the ſame Length, ſuſpended from a ſilk Line, vibrated backward and forwards two or three times, being firſt attracted, and then repelled, and continuing ſome time repelled; but upon joining the Top of the Tube, by a Packthread going round it, to the Loop of the Thread, the Thread continued conſtantly in a State of Repulſion, ſhewing no Tendency to Attraction.

### EXPERIMENT IX.

Two black Silks, about the ſame Length with the Thread in the preceding Experiment, were ſuſpended by Loops from an horizontal red ſilk Line, at the Diſtance of about half an Inch from each other; upon holding the excited Tube under them, the Silks ſwelled out from one another, and then jump'd away on each Hand to the Diſtance of two Feet.

### EXPERIMENT X.

A circular Board of nearly the ſame Diameter with the electric Cake, was ſuſpended horizontally by ſix ſilk Lines, tied to one ſilk Line which was brought over a Pulley at the Top of a Frame of Wood, ſo as to be moved up and down. From the Board hung ſix fine white Threads about eighteen Inches long, fixed by a little Cement at equal Diſtances from each other. The Board being let down till the Ends of the Threads were about an Inch diſtant from the electric Cake, which was directly under, and had the ivory Ball on its Centre; the Threads all approached towards the Centre of the Cake, both when the Ball was in the Centre, and when taken away, keeping an equal Diſtance from the Centre, and from one another, as long as a Packthread joined the Circle of Board and the Frame to keep it ſteady; and upon removing the Ball out of the Centre towards the Circumference, the Figure lengthen'd, the Threads next the Ball advancing nearer the Circumference; when the Ball was placed at about an Inch Diſtance from the Circumference, the Thread that was before neareſt the Circumference, whipp'd between the Ball and the Centre, ſo as to be almoſt in the ſame Plane with its two neighbouring Threads, the Figure form'd by the Extremities reſembling an Ellipſe with one End cut off: But when inſtead of the Packthread that join'd the Board to the Frame, a blue ſilk Line was tied in the ſame manner in all reſpects, the Threads, inſtead of coming towards the Centre, all flew away at a great Diſtance from the Cake, and from one another.

It ought to be obſerved in the Experiments of the circular Motion of the pendulous Body, that Mr. *Wheler's* Hand ſeem'd as ſteady as poſſible, except in the firſt Experiment, when a little Trembling appear'd; Mr. *George Graham* taking a very good Method to obſerve it, by keeping his Eye fix'd upon a Point at a conſiderable Diſtance, in the ſame Line with the End of Mr. *Wheler*'s Finger, and his own Eye.

Yet when Mr. *Wheler* had finiſh'd the Experiments to the Satisfaction of all preſent, Mr. *Hawskbee*, Mr. *George Graham*, and Dr. *Mortimer*, held the Thread with the pendulous Body over the Cake with the Ball on its Centre, after the Cake had been excited by Mr. *Wheler*; but they had no regular Revolutions at all, though ſeveral very manifeſt Motions were made with the Hand, to try if a projectile Motion might by that means be given to the pendulous Body. Mr. *Wheler* had tried the ſame thing with his Servant; from whence it is reaſonable to conclude, that it is neceſſary, that the ſame Perſon who excited the Cake ſhould likewiſe hold the Thread; as if there were ſome Analogy between the *Effluvia* excited by the clapping of the Hand on the Cake, and the *Effluvia* which may be communicated along from the Hand which holds the Thread to the Piece of Cork at the End of it. And this ſeems to be the Reaſon of what the late Mr. *Grey* told me, *viz.* That there was ſomething in the human Hand eſſential to the Experiment, which he had not yet found in any other Supporter of the Thread.

# IV. *A Letter from* Granvile Wheler, *Eſq;* to *Dr.* Mortimer, *Secr.* R. S. *containing ſome* Remarks *on the late* Stephen Gray, F. R. S. *his* Electrical Circular *Experiment.* *

*SIR,*

SOME odd Circumſtances led me to make Mr. *Gray*'s circular Experiment in the following Manner. While I excited a Cake of Roſin and Bees-wax ten Inches Diameter, by clapping with my Hand, I let my ivory Ball continue in a Baſin of Water; then ſhaking off the Drops, placed it in the Centre, and with my right Hand held a fine Thread, about eight or nine Inches long, having one End rolled up into a little Ball, and the other, for about an Inch, reduced to its greateſt Fineneſs, to only one Fibre, myſelf and Hand being ſupported on the Back of a Chair. The Succeſs was, I had a great many Revolutions, to the Number of Fifty, from Weſt to Eaſt; but at firſt not ſo regular as towards the laſt, at firſt deſcribing only about one third Part of the Circumference at a time, and after ſtanding ſtill a little, deſcribing another third Part. I might probably have had a great many more Revolutions, but being tired, I was forced to reſt myſelf, which I did for ten Minutes, then took up the Thread again. The Thread ſtood repelled at ſome Diſtance, without making any Revolutions, and at laſt only made half an one the contrary way to what it did before; but upon wetting it, by drawing it two or three times over the Surface of the Water, it made again twenty more Revolutions from Weſt to Eaſt, only at a ſmaller Diſtance from the Ball, (for the Water muſt make it heavier) but full as regular as before, and rather quicker: The Virtue of the Cake muſt now have laſted about three quarters of an Hour. After reſting about ſix Minutes, I tried again with the String freſh wetted, the Ball and Cake continuing as before; and had, to my great Surprize, one hundred Revolutions in the Space of about twelve Minutes, the Revolutions being ſtill quicker, and more regular, and nearer the Ball; and at the ſixth Revolution of this laſt Hundred, the Thread was attracted to the Surface of the Ball, and, being wet, did not diſengage itſelf, till pulled away; yet after this, deſcribed the remaining Ninety-four Revolutions of the Hundred, and ſeemed inclined to deſcribe a great many more, but that I was forced to reſt my Arm again, which I did for about eight Minutes, then tried again, the Thread being freſh wetted, and had ſeventy Revolutions at nearly the ſame Diſtance from the Ball in leſs than nine Minutes, all very regular, and without any Attraction of the Thread to the Ball. I reſted again ſixteen Minutes, wet the Thread again, and held it as uſual; it was repelled at about half an Inch Diſtance from the Ball, but ſeemed to have no Tendency to a circular Motion; yet after continuing ſtationary about a Minute, I perceived a Motion about its Axis, about which it took ſeveral Turns; but ſtill had little or no progreſſive Motion, till about a Minute longer, when it began to move forward, and continued doing ſo from Weſt to Eaſt, for about thirty-three Revolutions, very regular, but ſlower than in the two laſt Caſes, the String having been held about ten Minutes,

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* See *Philoſophical Tranſactions*, *n.* 441, *p.* 220. and *n.* 444, *p.* 400. of the Revolutions of *pendulous Bodies* by Electricity.

nutes, and the Revolutions performed in about ſeven or eight of them. I obſerved each of theſe three laſt times, it was rather longer before the progreſſive Motion began than uſual; and in all the Trials of this Experiment, I frequently perceived a Motion about the Axis, which was generally from Weſt to Eaſt, though now-and-then the contrary Way. The Virtue of the Cake muſt now have laſted near two Hours; about three quarters of an Hour after, I tried again, and had ſixty Revolutions from Weſt to Eaſt, in about ten Minutes, the Diſtance from the Ball being ſtill leſs than before, hardly one quarter of an Inch, ſcarce any Revolution about the Axis appeared, and at the Beginning the Thread was twice attracted to the Ball. About an Hour and half after, the Virtue of the Ball was not quite gone, the wet Thread being repelled, and making three or four Revolutions from Weſt to Eaſt, as well as moving a little about its Axis the ſame Way. But as it was reaſonable to ſuppoſe the Ball itſelf in the Centre of the Cake was now dry, with a Feather dipp'd in Water I wet its Surface; yet found no Increaſe of Virtue, rather a Diminution of it, the pendulous Body ſeeming ſcarce at all repelled; but it is to be obſerved, that the Ball, as it was wetting, twice tumbled over, and rolled upon the Surface of the Cake; by which means the Virtue of the Cake might be much diminiſhed.

It is not improper too to take Notice here, that during the Revolutions of the wet String, I have frequently obſerved a kind of Oſcillatory Motion, as if there was an alternate Intention and Remiſſion of the repulſive Force. As alſo that I have often took Notice of little Plucks, and convulſive Motions, in the pendulous Body, and ſometimes thought I have felt ſomething like it in my Arm that held it, though at no other time have I ever been ſenſible of any ſuch thing.

I have ſeveral times ſince repeated this Experiment with the Thread and Ball both wet, and found it ſucceed much better than when they were both dry; and once I find by my Notes I had two hundred and twenty Revolutions before I reſted my Arm. I have tried too with the Ball dry, and the String only made wet; but the Virtue did not continue ſo long, as when both were wet.

I now flattered myſelf with Hopes of Succeſs, if the Thread was ſuſpended from an undoubted fixed Point, which therefore I proceeded again to try with the greateſt Care and Caution, but in vain; the Revolutions were uncertain.

This Difference naturally led me to reflect upon the Cauſe of it. The Tremor of the Hand would not account for it; for this being both ways backward as well as forward, muſt as often hinder as promote a continual Motion one way: And though in two oppoſite Parts of a Circle, the Motion is really in contrary Directions, and therefore the contrary Impulſes of a Tremor may promote a Revolution applied at oppoſite Places of the Orbit; yet as theſe Tremors are irregular, and ſucceed much quicker than the Revolutions are perform'd, they ſeem inſufficient to account for the Motions of the pendulous Body, performed with any Degree of Regularity.

A Stream of Air in my Room might impel along the Tangent the pendulous Body, kept at a Diſtance from the Ball by its repulſive Force; and then Gravity, taking place, might with the firſt Motion compound a Curve; but ſtill the Reſiſtance of the Air would ſoon deſtroy the original Impulſe, could a few Revolutions be performed; and beſides, one Revolution could not be performed, becauſe the ſame Stream of Air that began the Motion, muſt be contrary to it in its Return.

A Finger held on the right Hand near the pendulous Body, when ſuſpended from a fixed Point, will make it revolve from Weſt to Eaſt; but then it muſt be applied and removed alternately: The repulſive Force therefore which the Arm may acquire, by being held in the Sphere of the *Effluvia*, is inſufficient; for, as it is in one Place, it muſt impel only one way, and conſtantly the ſame way; and therefore, like a Stream of Air in the Room, though it might create the Beginning, it muſt hinder the Completion of a Revolution.

Sometimes I have doubted, whether the Pulſe of the Arm might not be aſſiſting in giving a projectile Motion. When one Leg is laid over the Knee of the other, a Motion and Heaving of the Leg that lies over, anſwering to every Stroke of the Pulſe, is very apparent at a Diſtance: The Arm therefore in ſome Poſtures, in which its great Artery meets with a proportionable Preſſure or Reſiſtance, may have a conſtant Motion, though leſs perceivable.

What ſeemed the moſt probable Solution, was this: When the Arm is extended, the Poſture being uneaſy, there muſt be a Reaction of the Muſcles, or a continual pulling of the Arm towards the Body. When therefore the right Arm is made uſe of, the pulling will be from Right to Left; and conſequently the Motion produced in the Body held by it in the ſame Direction, or from Weſt to Eaſt. When the left Arm is made uſe of, the Reaction of the Muſcles will be from Left to Right, and therefore the Motion of the pendulous Body from Eaſt to Weſt. And, agreeably to this, I have obſerved, (as I formerly took Notice, though this Reaſon did not then occur to me) when I uſed my left Hand, all other Circumſtances continuing the ſame, the Motion of the pendulous Body was from Left to Right, or from Eaſt to Weſt, contrary to what was obſerved when held by the right Hand.

Yet ſtill neither of theſe Solutions would account for the Variety of Oddneſſes I have met with under various Circumſtances.

I proceeded therefore to try with Reſts for my Arm of different Heights, having an Arm of Wood, about two Feet long, fixed to a Reſt for my Teleſcopes, which I could raiſe to any Height I wanted; and I found the Experiment ſucceed only well, when the Reſt was lower than the electric *Area*, and the Arm was ſupported upon its Elbow, which was the Poſture conſtantly made uſe of, when reſted upon a Chair, the Chair being lower than the electric *Area*, that it might leſs affect the *Effluvia*, as was then thought.

I began now to think with myſelf, whether it was not poſſible, that an Inclination to a Motion one way in the Perſon that holds the Body, might not have ſuch an Influence upon the Arm, and conſequently the String and pendulous Body, as to determine them the ſame way by ſome Preſſure or Byaſs put upon it, though no Motion ſenſible even to himſelf, was produced in the Hand. If ſo, I might, by a contrary Inclination, produce a *Motion* the contrary way. Having therefore a fine Day, and my circular Cake being well excited, I tried if I could not produce a regular Motion from Eaſt to Weſt, about the Ball in the Centre, having my Hand ſupported, as uſual, upon the Back of a Chair. I found I could produce a very regular one from Eaſt to Weſt for many Revolutions, and change from one Motion to another, without being ſenſible I moved my Hand at all.

I then wet the Ball and String, as in the Experiment before-mentioned, and found I could tire myſelf with a Motion either from Eaſt to Weſt, or from Weſt to Eaſt, as I pleaſed, without giving any Motion, that I could perceive, to my Hand or Fingers. Hence many odd Experiments that pleaſe, may, when repeated, ſucceed.

Since therefore the Motion of the pendulous Body from a Point undoubtedly fixed, is irregular, as I have found by many different Experiments, repeated with the greateſt Care and Caution; and ſince I am convinced from theſe laſt-mentioned Trials, the Motion from Weſt to Eaſt, and from Eaſt to Weſt, muſt generally have been determined by myſelf; I am nclined to think, that a Deſire of producing a Motion from Weſt to Eaſt, was the ſecret Cauſe that determined the pendulous Body to that Direction, by ſome Impreſſion from Mr. *Gray*'s Hand, as well as my own, though I am perſuaded at the ſame time, he was not ſenſible of giving any Motion to his Hand himſelf: And I the rather think this was the Caſe, from the Inſtance Mr. *Gray* gives, by way of Explanation,

nation, of a Man reſting his Elbows upon his Knees, this implying that he reſted his Arm upon his Elbow, as I did myſelf.

But though upon the Whole it does at laſt appear, that this Motion from Weſt to Eaſt in a pendulous Body, applied to another in the Centre of an electric *Area*, is to be aſcribed to the Hand that holds it, and not ſolely to the Nature of the electric *Effluvia*, or the Figure of the central Body; yet ſtill, perhaps, it may not be improper for Aſtronomers to conſider, whether or no a Medium with this Property, that all Bodies immerſed in it, are repulſive of one another, ought not to be joined with Gravity to explain the heavenly *Phænomena*; eſpecially ſince the *Phænomena* of Fire, and our electric *Effluvia*, have a great Affinity to each other; and ſince many of the heavenly *Phænomena* are to be accounted for, upon this Suppoſition, with great Simplicity; and ſome of them, that have not yet perhaps been fully accounted for, ſeem neceſſarily to follow.

I am, Sir, with a very great Regard,

*Otterden-Place,*
*Feb.* 20. 1737-8.

*Your much obliged,*
*humble Servant,*

**Granv. Wheler.**

*P S.* This was intended to have been ſent eleven Days ago.
*Mar.* 3. 1737-8.

# V. *An Account of the* Influence *which two* Pendulum Clocks *were obſerved to have upon each other, by Mr.* John Ellicott, *F. R. S.*

THE two Clocks upon which the following Obſervations were made, being deſigned for Regulators, particular Care was taken to have every Part made with all poſſible Exactneſs: The two Pendulums were hung in a manner different from what is uſual; and ſo diſpoſed, that the Wheels might act upon them with more Advantage. Upon Trial they were found not only to move with greater Freedom than common, but an heavier Pendulum was kept in Motion by a ſmaller Weight. They were in every reſpect made as near alike as poſſible. The Ball of each of the Pendulums weighed above 23 ℔; and required to be moved about 1° 5′ from the Perpendicular, before the Teeth of the ſwing Wheel would ſcape free of the Pallets; that is, before the Clocks would be ſet a going. The Weight to each was 3 ℔, which would cauſe either of the Pendulums in their Vibrations to deſcribe an Arch of 3°. The two Clocks were each in Caſes, which ſhut very cloſe, and placed Sideways to one another, ſo near that when the Pendulums were at Reſt, they were little more than about two Feet aſunder. The odd *Phænomena* obſerved in them were theſe: In leſs than two Hours after they were ſet a going, one of them (which I call N° 1.) was found to ſtop; and when ſet a going again, (as it was ſeveral times) would never continue going two Hours together. As it had always kept going with great Freedom, before the other Clock (which I call N° 2.) was placed near it, this led me to conceive its ſtopping muſt be owing to ſome Influence the Motion of one of the Pendulums had upon the other; and upon watching them more narrowly, I found the Motion of N° 2. to increaſe as N° 1. diminiſhed; and at the time N° 1. ſtopped, N° 2. deſcribed an Arch of 5°, that is nearly two Degrees more than it would have done, if the other had not been near it, and more than it did move in a ſhort time after the other Pendulum came to be at Reſt: This made me imagine that they had a mutual Influence upon each other. Upon this I ſtopped the Pendulum of N° 2. leaving it quite at Reſt, and ſet N° 1. a going, the Pendulum deſcribing as large an Arch as the Caſe would permit, *viz.* about 5°. In about 20 Minutes after, I went to obſerve whether there was any Motion communicated to the Pendulum N° 2. when, to my Surprize, I found the Clock going, and the Pendulum to deſcribe an Arch of 3°, whereas at the ſame time N° 1. did not move 4°. In about half an Hour after, N° 1. ſtopped, and the Motion of N° 2. was increaſed to very near 5°. I then ſtopped N° 2. a ſecond time, and ſet N° 1. a going, as before; and ſtanding to obſerve them, I preſently found the Pendulum of N° 2. to begin to move, and the Motion to increaſe gradually, till in 17′ 40″ it deſcribed an Arch of 2° 10′, at which time the Wheel diſcharging itſelf of the Pallets, the Clock went. The Arches of the Vibrations continued to increaſe, till (as in the former Experiment) the Pendulum moved 5°; the

Motion of the Pendulum N° 1. gradually decreaſing all the while, as the other increaſed; and in three Quarters of an Hour after, it ſtopped. I then left the Pendulum of N° 1. at Reſt, and ſet N° 2. a going, making it deſcribe an Arch of 5°; it continued to vibrate leſs and leſs, till it deſcribed but about 3°; in which Arch it continued to move all the time I obſerved it, which was ſeveral Hours. The Pendulum of N° 1. ſeemed but little affected by the Motion of N° 2. I tried theſe Experiments ſeveral times over, without finding any remarkable Difference. The freer the Room was from any Motion (as Peoples walking about in it, *&c.*) I found the Experiments to ſucceed the better; and once I found N° 2. ſet a going in 16′ 20″, and N° 1. at that time ſtopped in 36′ 40″.

I ſhall not offer my Opinion to this Honourable Society, concerning the Cauſe of theſe *Phænomena*, or at leaſt not till I have farther examined it by the Help of ſome more Obſervations and Experiments.

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## VI. *Further* Obſervations *and* Experiments *concerning the two* Clocks *above-mentioned, by* the Same.

IN the preceding Paper I had the Pleaſure to communicate to this Honourable Society, an Account of the extraordinary Influence I obſerved two Clocks to have upon each other, and which was attended with ſuch Circumſtances, as I believe had never before been taken Notice of. I ſhall now beg

Leave to lay before you ſome farther Obſervations I have ſince made, which will, I hope, in great meaſure, account for the Facts then related.

In my former Account I took Notice, that the two Clocks were in ſeparate Caſes, and that the Backs of them reſted againſt the ſame Rail; that the Pendulums, when at Reſt, were about two Feet aſunder, and weighed about 23 ℔ each, and were made to move with ſuch Freedom, that a Weight of 3 ℔. would cauſe either of the Pendulums to deſcribe an Arch of three Degrees. The moſt remarkable Particulars then obſerved in them were theſe: If the Pendulum of one of the Clocks, which (for Diſtinction ſake) I called N° 2. was left at Reſt, and that of the other, which I called N° 1. was ſet a going, this would, in about 16 Minutes, communicate ſo great a Quantity of Motion to N° 2. as would make its Pendulum deſcribe an Arch of above two Degrees, and would ſet the Work a going: That the Motion of the Pendulum of N° 1. conſtantly decreaſed as that of N° 2. increaſed, and after about 30 Minutes it did not deſcribe an Arch ſufficient to free the Teeth of the Wheel from the Pallets, ſo that the Clock ſtopped. At the ſame time the Pendulum of N° 2. deſcribed an Arch of five Degrees, which was two Degrees more than it would have done, had it not been affected by the Motion of N° 1. Upon leaving the Pendulum of N° 1. at Reſt, and ſetting N° 2. a going, the Pendulum of N° 1. was found to be but little affected, and never moved ſufficiently to ſet the Work a going. Theſe ſeemingly different Effects, which the two Clocks had upon each other, I ſhall now endeavour to account for.

The Manner in which the Motion is communicated to the Pendulum at Reſt, I conceive to be thus: As the Pendulums are very heavy, when either of them is ſet a going, it occaſions by its Vibrations a very ſmall Motion, not only in the Caſe the Clock is fixed in, but, in a greater or leſſer Degree, in every thing it touches; and this Motion is communicated to the other Clock, by means of the Rail, againſt which both the Caſes bear. The Motion thus communicated, which is too ſmall to be diſcovered but by means of ſome ſuch-like Experiments as theſe, will, I doubt not, be judged by many, inſufficient to make ſo heavy a Pendulum deſcribe an Arch of two Degrees, or large enough to ſet the Work a going; and indeed it would be ſo, but for the very great Freedom with which the Pendulum is made to move, ariſing from the Manner in which it is hung. This appears from the very ſmall Weight required to keep it going, which, when the Clock was firſt put together, was little more than one ℔. And if the Weight was taken off, and the Pendulum made to ſwing two Degrees, it would make 1200 Vibrations before it decreaſed half a Degree, ſo that it would not loſe the $\frac{1}{3000}$ part of an Inch in each Vibration. Indeed if the Weight was hung on, the Friction would be increaſed, and the Pendulum would not move quite ſo freely; but even in that Caſe it was found to loſe but little more than the $\frac{1}{2000}$ part of an Inch, or about three Seconds of a Degree, in one Vibration; and therefore if the Motion communicated to it from the other, will make it deſcribe an Arch exceeding three Seconds, the Vibrations muſt continually increaſe till the Work is ſet a going.

And that the Motion is communicated in the manner above ſuppoſed, is confirmed by the following Experiments:

A Prop was ſet againſt the Back of the Caſe of N° 2. to prevent its bearing againſt the Rail; and N° 1. was ſet a going; then obſerving them for ſeveral Hours, I could not perceive the leaſt Motion communicated to N° 2. I then ſet both the Clocks a going, and they continued going ſeveral Days; but I could not find they had any Influence upon each other. Inſtead of the Prop againſt the Back of the Caſe, I put Wedges under the Bottoms of both the Caſes, to prevent their bearing againſt the Rail; and ſtuck a Piece of Wood between them, juſt tight enough to ſupport its own Weight. Then ſetting N° 1. a going, I found the Influence ſo much increaſed, that N° 2. was ſet a going in leſs than ſix Minutes, and N° 1. ſtopped in about ſix Minutes after. In order to try what Difference would ariſe, if the Clocks were fixed on a more ſolid Floor, I placed them (exactly in the ſame manner as in the laſt Experiment) upon the Stone Pavement under the Piazza's of the *Royal Exchange*, and ſtuck the Piece of Wood between them, as before; and ſetting N° 1. a going, the only Difference I could perceive, was, that it was 15 Minutes before N° 2. was ſet a going, and N° 1. continued going near half an Hour before it ſtopped. From theſe Experiments I think it plainly appears, that the Pendulum which is put in Motion, as it moves towards either ſide of the Caſe, makes the Preſſure upon the Feet of the Caſe to be unequal, and, by its Weight, occaſions a ſmall Bearing or Motion in the Caſe on that Side towards which the

Pendulum is moving; and which, by the Interpoſition of any ſolid Body, will be communicated to the other Clock, whoſe Pendulum was left at Reſt. The only Objection to this, I conceive, is the different Effects which the two Pendulums ſeemed to have upon each other. But this I hope to explain to Satiſfaction.

For, notwithſtanding theſe different Effects, I ſoon found, by ſeveral Experiments, that the two Clocks mutually affected each other, and in the ſame Manner, though not with equal Force; and that the Varieties obſerved in their Actions upon each other, aroſe from the unequal Lengths of their Pendulums only.

For, upon moving one of the Clocks to another Part of the Room, and ſetting them both a going, I found that N° 2. gained of N° 1. about one Minute 36 Seconds in 24 Hours. Then fixing both againſt the Rail, as at firſt, I ſet them a going, and made the Pendulums to vibrate about four Degrees; but I ſoon obſerved that of N° 1. to increaſe, and that of N° 2. to decreaſe; and in a ſhort time it did not deſcribe an Arch large enough to keep the Wheels in Motion. In a little time after it began to increaſe again, and in a few Minutes it deſcribed an Arch of two Degrees, and the Clock went. Its Vibrations continued to increaſe for a conſiderable time, but it never vibrated four Degrees, as when firſt ſet a going. Whilſt the Vibrations of N° 2. increaſed, thoſe of N° 1. decreaſed, till the Clock ſtopped, and the Pendulum did not deſcribe an Arch of more than one Degree 30 Minutes. It then began to increaſe again, and N° 2. decreaſed, and ſtopped a ſecond time, but was ſet a going again, as before. After this N° 1. ſtopped a ſecond time, and the Vibrations continued to decreaſe till the Pendulum was almoſt at Reſt. It afterwards increaſed a ſmall matter, but not ſufficiently to ſet the Work a going. But N° 2. continued going, its Pendulum deſcribing an Arch of about three Degrees.

Finding them to act thus *mutually* and *alternately* upon each other, I ſet them both a going a ſecond time, and made the Pendulums deſcribe as large Arches as the Caſes would permit. During this Experiment, as in the former, I ſometimes found the one, and at other times the contrary Pendulum to make the largeſt Vibrations. But as they had ſo large a Quantity of Motion given them at firſt, neither of them loſt ſo much during the Period it was acted upon by the other, as to have its Work ſtopped, but both continued going for ſeveral Days without varying one Second from each other; though when at a Diſtance, as was before obſerved, they varied one Minute 36 Seconds in 24 Hours. Whilſt they continued thus going together, I compared them with a third Clock, and found that N° 1. went one Minute 17 Seconds faſter, and N° 2. 19 Seconds ſlower, than they did when placed at a Diſtance, ſo as to have no Influence upon each other.

Upon altering the Lengths of the Pendulums, I found the Period in which their Motions increaſed and decreaſed, by their mutual Action upon each other, was changed; and would be prolonged as the Pendulums came nearer to an Equality, which from the Nature of the Action it was reaſonable to expect it would. This diſcovers the Reaſon why the Pendulum of N° 2. when left at Reſt, would be ſet a going by the Motion of N° 1. whereas if N° 1. was left at Reſt, it would not be ſet a going again by the Motion of N° 2.

For I found by ſeveral Experiments, that the ſame Pendulum, when kept in Motion by a Weight, would go faſter, than when it only moved by its own Gravity. On this Principle, which may eaſily be accounted for, it follows, that during the Time in which the ſhorteſt Pendulum, N° 2. was only acted upon by N° 1. it would move ſlower, and the Times of its Vibrations approach nearer to an Equality with thoſe of N° 1. than after it came to be kept in Motion by the Weight; and by this means the Time which N° 1. would continue to act upon it, would be prolonged, and be more than was required to make the Pendulum deſcribe an Arch ſufficient to ſet the Work a going. But on the contrary, while the Pendulum of N° 1. which was the longeſt, was only acted upon by N° 2. as it would move ſlower, the Difference of the Times of the Vibrations would be increaſed; and conſequently the Time which N° 2. would continue to act upon it, would for this Cauſe be ſhortened, ſo that before the Pendulum of N° 1. would deſcribe an Arch ſufficient to ſet the Work a going, the Period of its being acted upon would be ended, and it would begin to act upon N° 2. at which time its Vibrations would immediately decreaſe, and continue to do ſo till it came to be almoſt at Reſt. And thus it would continue ſometimes to move more, and at other times leſs, but never ſufficiently to ſet the Clock a going.

This Account might be confirmed by many more Experiments I have made relating to this Subject; but as I hope theſe already mentioned will be thought ſufficient to confirm the Truth of what I have advanced, I ſhall forbear to treſpaſs any longer on your Time, and ſubſcribe myſelf

*Your moſt obedient*
*humble Servant,*

John Ellicott.

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## VII. *The* Caſe *of a Wound in the* Cornea *of the* Eye *being ſucceſsfully cured by Mr.* Tho. Baker, *Surgeon to St.* Thomas's *Hoſpital, and by him communicated to the* ROYAL SOCIETY, *in a Letter to Dr.* Mortimer, R. S. *Secr.*

A Young Woman, about the Age of 15 Years, on the 6th Day of *November* 1733, received a Wound juſt in the Pupil of her right Eye, by the Spear of a common Fork. An Inflammation followed, with great Pain. The whole Eye appeared dark and turbid; and the Humours ſeemed confuſed, and blended together. I opened a Vein in the Arm, and drew away 10 Ounces of Blood: I then waſhed the Eye with a Collyrium of *Trochiſci Albi Rhaſis*, and common Water, made Blood-warm; and dreſſed it with a Cataplaſm of white Bread and Milk, with a little Saffron in it. The next Day there appeared on the wounded Part of the *Cornea*, a large thick Slough: I dreſſed her in the ſame Manner, and ſo continued till the 18th Day of the ſame Month, when the Slough caſt off. I purged her during this Time with *Decoct. Sennæ* ℥ij, *Mann. Solut.* ℥ſs, *Aq. Pæon. comp.* ʒij; *m. f. Pot.* at the Diſtance of about three Days, juſt as I found her Strength would permit. The Inflammation and Pain abated daily. During the whole Time, the Eye was quite blind, till the Slough caſt off, when ſhe complained ſhe ſaw double. In a very little time her Sight returned, but not ſo perfect as before; her Eye having ſomewhat of a Cloud before it.

I made her ſix Viſits at the Diſtance of two or three Days after the 18th: When I left her, ſhe ſaw perfectly well, that Cloud which ſhe before complained of, being removed; her Eye appeared fair and clear; and, as ſhe told me, was equally ſtrong and uſeful to her as her other. A little Speck (which was the Cicatrix of the Wound) remaining on the *Cornea*, I made her a Fontanel in the Arm, and ordered her to keep it open, and not to touch the Speck on her Eye. It is now more than two Years ſince, the Speck has gradually decreaſed, and is now ſo ſmall, that it is ſcarce viſible; and her Sight is as perfect and ſtrong as before this Accident.

*Thomas Baker*, Surgeon.

## VIII. *Extract of a Letter dated at* Montpelier, Dec. 27. 1731. *N. S. from* Andrew Cantwell, *M. D.* Monſpel. *to* T. S. *M. D. and by him tranſlated from the* French, *giving an Account of a* monſtrous Boy.

THERE is actually in this Town, a Lad of thirteen Years of Age, born at *Cremona*, who bears the lower Parts of another Boy, which ſeem to iſſue from his Epigaſtric Region, between the *Cartilago enſiformis* and the Navel. The Fore-part of the one faces that of the other. The Head and Trunk ſeem buried in the Lad's *Abdomen*, down to the Hips, where the Connection is plainly to be ſeen. This Portion of the prominent Body has a well-form'd *Anus* and *Penis*. The *Scrotum* has a fine Down on it, but is void of Teſticles, and ſeems to be filled with the Inteſtines. Nothing paſſes through theſe two Outlets. I have perfectly well diſtinguiſhed the two *Oſſa Iliûm* in their natural State, but could not feel the *Os Sacrum*. The Articulation of the *Femur* is ſomewhat diſcernible on each Side: and I have perceived the Pulſation of the anterior crural Arteries. The Lad is very ſenſible when theſe additional Feet, Legs, or Buttocks, are pinched, or over-much preſſed. He has lately had the Small-pox, and theſe have ſuffered by it equally with him. At his Navel I found a conſiderable Rupture, which is covered by this Portion of a Body. This Rupture grows monſtrouſly big in wet Weather, and diminiſhes again in dry. It has a circular Hole in it, which runs through the *Peritonæum.* The Lad is of a thin Habit of Body, but otherwiſe enjoys good Health. His Father, *Michael Martinetti*, a Tinker, told me, that this is the ſeventh Child his Wife *Nunciada* bore him. She was thirty Years of Age at his Birth, and bore him two more ſince. All the reſt were of the natural Shape.

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## IX. *Three extraordinary Caſes in* Surgery, *by* Bezaleel Sherman, *Surgeon, at* Kelvedon *in* Eſſex, *communicated in* November 1738.

S*AMUEL Buſh*, of the Pariſh of *Wickham-Biſhops*, in *September* 1704. being on the Top of a very high Timber Tree, in order to ſhake down the Acorns, he let go his Hold; and by falling from one Bough of the Tree upon another, he broke his Thigh-bone; and one End of it, by the Force of the Fall, ſtuck faſt in the Ground, which fractured the Bone in another Place, about two Inches and an half above the former. This intire Piece of the *Os Femoris* was taken out; notwithſtanding which, ſo large a *Callus* united the two Ends of the Bone, that his Thigh (when cured) was very little more than a quarter of an Inch ſhorter than the other Thigh. The Surgeon who had the Care of him, uſed his greateſt Endeavours, during the Cure, to preſerve the Extenſion; but he imputed the Largeneſs of the *Callus* to a very great Quantity of *Lap. Oſteocolla*, which he made him take for ſix Weeks or two Months, in Powder with Milk, in an Electuary, in his Bread, and in his Pudding; in ſhort, in almoſt all the Food he took.——

—— *Fitch*, of the Pariſh of *Keldon*, had a foul Ulcer in his Mouth, with a *Caries* in the lower Jawbone, one Part of which, from the Suture at the Chin to the End of it under the Ear, in Proceſs of Time intirely came out, with three Teeth in it. This was alſo owing to a great Quantity of *Oſteocolla* internally given, which was thought not only to expedite this large Exfoliation, but at the ſame time to generate ſo large and firm a *Callus*, that he can chew an hard Cruſt, or any other Food, on that Side as well as on the other.——

*John Spilman*, Bricklayer, of *Maldon*, came to me the 3d of *October* 1734. having a ſinuous Ulcer in his *Rectum*, about two Inches from the *Anus*. This had remained a Twelvemonth, and was taken for the Piles, and treated as ſuch, both internally and externally. I ſoon perceived a Tumour in his Buttock two or three Inches from the *Anus*, which coming to Suppuration, I opened it by Inciſion; and after dreſſing it ſeveral Weeks with little Proſpect of Succeſs, I diſcovered at the Bottom of the Ulcer ſomething that looked like a Bone, which when extracted, proved to be the lower Jaw of a Fiſh, as a *Whiting*, or young *Cod*, &c. And unqueſtionably this was ſwallowed at leaſt a Year before it came away, becauſe the pricking Pain he felt when the ſharp End of the Bone ſtuck in the *Rectum*, was the Symptom miſtaken for the Piles; and when this had made its Way thro' the *Rectum*, and got into the fleſhy Part, the Apoſthume followed in courſe; and the Bone being extracted, the Ulcer was ſoon cicatrized by the common Methods of Cure in ſuch Caſes.

*N. B.* All theſe Perſons are yet living, and will atteſt the Truth of the Caſe.

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## X. *A Letter from* Tho. Stack, *M. D. to Sir* Hans Sloane, *Bart. Pr.* R. S. *&c. containing an Account of a* Woman ſixty-eight Years of Age, *who gave* Suck *to two of her Grand-children.*

*Honoured SIR,*

A Gentleman of Credit having lately inform'd me of a Woman near ſeventy Years old, who actually ſuckles one of her Grand-children, and courteouſly offering to accompany me to her, excited my Curioſity to ſee ſo uncommon a Sight; and the more, in order to try if I could not diſcover ſome Fallacy in the Affair. Wherefore I went Yeſterday, in Company with the aforeſaid Gentleman, to a Houſe in *Tottenham-Court-Road,* where the Woman we inquired for appear'd in an Inſtant. Her Breaſts were full, fair, and void of Wrinkles; though her Face is very much wither'd, her Cheeks and Mouth vaſtly ſunk in, her Eyes red, and running with a clammy Humour; and though ſhe has, in ſhort, all the other external Marks that one may reaſonably expect to find in a Woman, who has ſpent the laſt Half of her paſt Life in Labour, Troubles, and other Concomitants of Poverty, and through them has reach'd near to her

70th Year. Upon preſſing her right Breaſt, ſhe fairly ſqueez'd out Milk, which gather'd in ſmall Drops at three of the Lactcal Ducts terminating in the Nipple. This Experiment I made her repeat a ſecond time, having myſelf carefully dry'd the End of the Nipple with my Handkerchief, as I had done before her firſt Trial. Convinced of the Truth of the Fact, I ask'd her ſeveral Queſtions, in order to procure Materials for a Hiſtory thereof. The Subſtance of her Anſwers was as follows:

Her Name by Marriage is *Elizabeth Brian*. She is in the ſixty-eighth Year of her Age ſince laſt *October*, and has not borne a Child theſe twenty Years and upwards. About four Years ſince, her Daughter being obliged to leave an Infant ſhe then gave Suck to, in the Care of this her own Mother, and likely to be a conſiderable time abſent; the old Woman, finding the Child froward for want of the Breaſt, apply'd it to her own, barely in order to quiet the Infant, without the leaſt Thoughts of Milk. And this having reiterated ſeveral times, a Son of hers, by that time grown a Man, perceiv'd that the Child ſeem'd to ſwallow ſomewhat from the Nipple; whereupon he begg'd Leave of his Mother to try if ſhe had not Milk. The Experiment ſucceeded: The Youth drew Milk from that ſame Breaſt from which he had been wean'd above twenty Years, and which had been unaccuſtom'd to any for ſeventeen or eighteen Years before: The good Woman then continued to ſuckle her Grand-child in earneſt: And in ſome time her Daughter, *viz.* the Infant's Mother, ſeeing ſhe was provided with ſuch an extraordinary and tender Nurſe, was embolden'd to bid fair for an Increaſe of Iſſue, which till then ſhe knew not how to nouriſh or provide for. Accordingly, at the End of two Years, ſhe brought forth another Child; whereupon the Grandmother wean'd the firſt, and ſuckled the latter; which ſhe has done theſe laſt two Years, and ſtill continues to do. And this Infant, in my Preſence, took the Nipple with as much Eagerneſs, and ſeeming Delight, as I ever perceived in a Child of two Years old; and at it plainly perform'd the Actions of Suction and Deglutition. The two Children, both Girls, are, as to Conſtitution, ſuch as I could wiſh to the deareſt Friend; plump and firm in Fleſh; in Complexion cleanly, fair and healthy, and in Temper brisk and ſprightly; conſidering the Lowneſs of their Condition and Education, and the mean Diet of the Nurſe.

When this good Woman came to Town, which was near two Years ſince, her Milk abounded to that Degree in both Breaſts, that, to convince the Unbelieving, ſhe would frequently ſpout it above a Yard from her: A Particular which, among others, the good Man and Woman of the Houſe, and others of the Neighbourhood, likewiſe aſſured me of. Now her left Breaſt is run dry, and ſhe has no great Quantity in the Right: But what there is, is as good Milk as one may deſire in a Nurſe.

The poor Woman ſeems perfectly honeſt and artleſs, and even inclines ſtrongly to Dotage. She very religiouſly throws the Whole upon a Miracle.

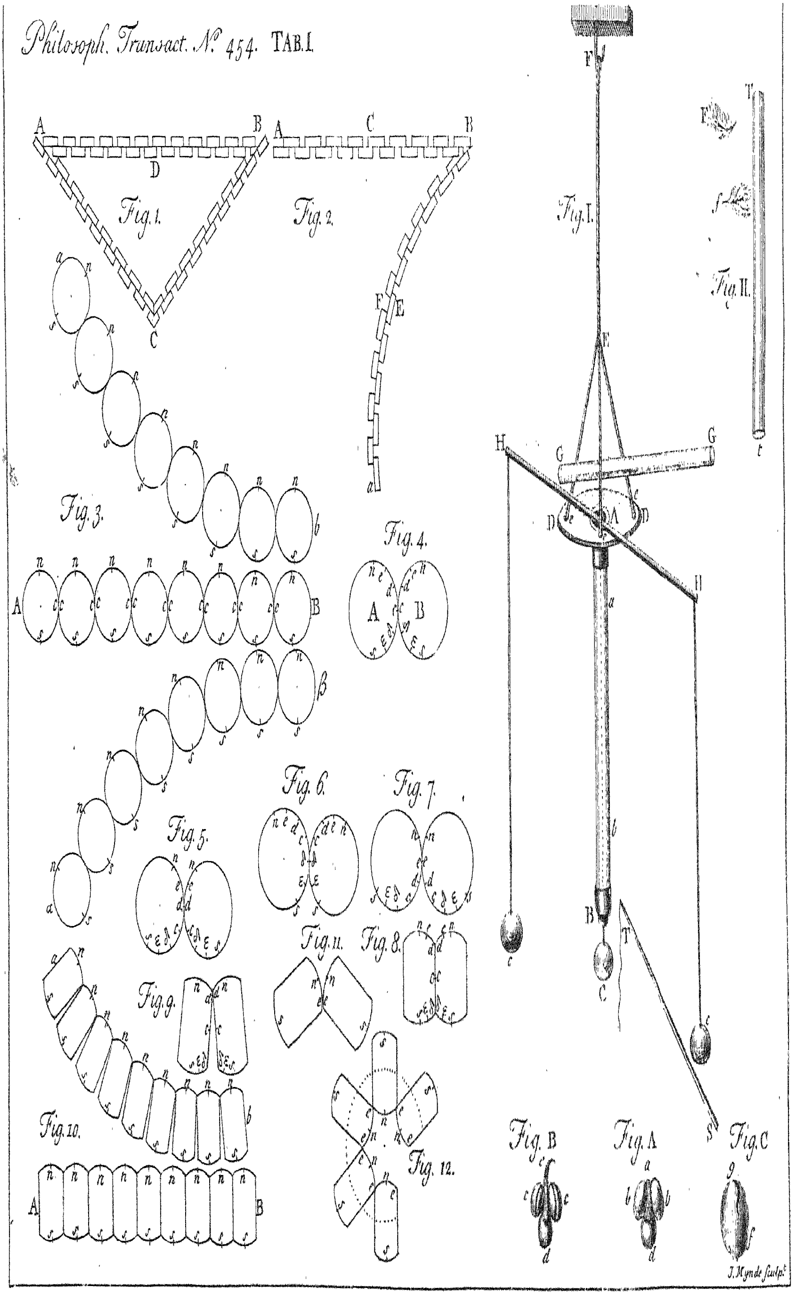
I beg Leave to ſubſcribe with Gratitude and Reſpect, both in a ſupreme Degree, *Honoured SIR*,

*London, Jan.* 8.
1733. *St. Jul.*

*Your moſt obliged*
*and obedient Servant,*

Thomas Stack.

Philosoph. Transact. Nº 454. TAB. I.



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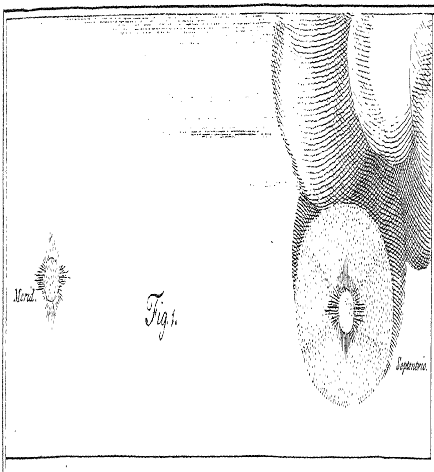
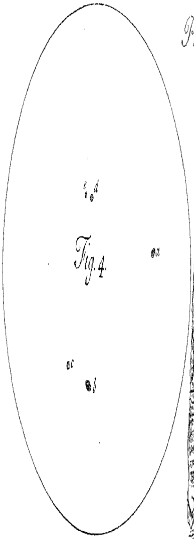
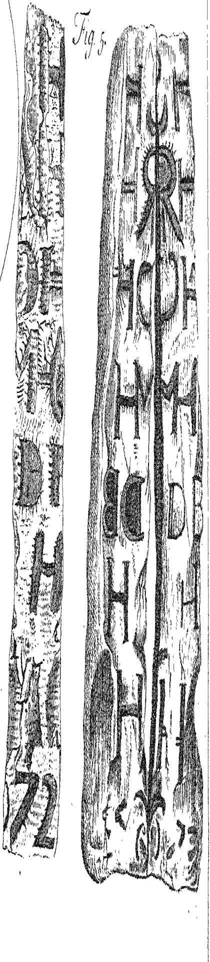
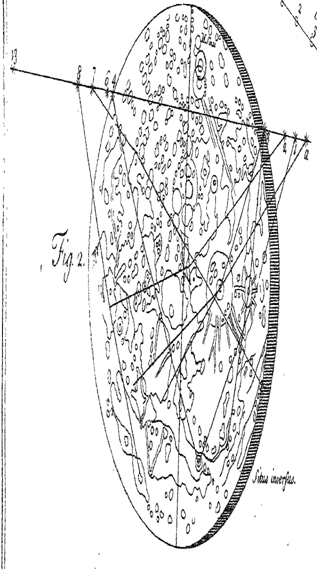
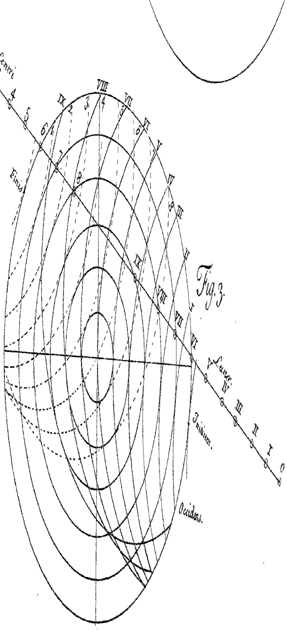
Philosoph. Transact. N°. 454. TAB. II.











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# PHILOSOPHICAL TRANSACTIONS.

For the Months of *July*, *Auguſt*, *September*, and *October*, 1739.

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II. *An* Experiment *to prove, that* Water, *when agitated by* Fire, *is infinitely more* elaſtic *than* Air *in the ſame Circumſtances; by the late Rev.* John Clayton, *Dean of* Kildare *in* Ireland. *Communicated by the ſame Hand as the preceding.*

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## I. *A Letter from the Rev$^{d}$ Mr.* John Clayton, (*afterwards Dean of* Kildare *in* Ireland) *to Dr.* Grew, *in Anſwer to ſeveral Queries relating to* Virginia, *ſent to him by that learned Gentleman*, A.D. 1687.[*] *communicated by the Right Reverend Father in God* Robert *Lord Biſhop of* Corke, *to* John *Earl of* Egmont, F. R. S.

I Have obſerved many groſs Miſtakes in Peoples Notions of *Virginia*, when diſcourſing of the Natives, which have riſen from the want of making a Diſtinction in their Expreſſions, when they ſpeak of the *Engliſh* or *Whites*, born there, and ſo called *Natives*; and the *Aborigines* of the Country. Pleaſe therefore to take Notice, that when I ſpeak of the Natives in general, I mean only the *Indians*.

As therefore to your firſt Query: Their *Wiochiſt*, that is, their Prieſt, is generally their Phyſician; and is a Perſon of the greateſt Honour and Eſteem among them, next to the King, or to their great War-Captain.

2. Nature is their great Apothecary, each Phyſician furniſhing himſelf, according to his Skill, with Herbs, or the Leaves, Fruit, Roots, or Barks of Trees; of which he ſometimes makes uſe of the Juice, and ſometimes reduces them into Powder, or perhaps makes a Decoction thereof.

3. Though every one, according to his Skill, is a ſort of Doctor, (as many Women are in *England*)

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[*] This may ſerve as a Sequel to the Accounts of *Virginia* formerly given by Mr. *Clayton*. See theſe *Tranſactions*, N° 201. 205, 206. 210.

yet their Prieſt is pecularly ſtyled their Phyſician, to be conſulted upon greater Emergencies. The Rules of the Deſcent hereof, as to Families, I do not know; for they are a ſullen cloſe People, and will anſwer very few Queſtions.

4. They reward their Phyſician with no certain Fees, but according as they bargain for *Wampaumpeake* Skins, or the like. If it be to an *Engliſhman* they are ſent for, they will agree for a Match-coat, a Gallon or two of Rum, or ſo-forth, according to the Nature of the Cure. Sometimes the Prieſt will ſell his Remedy; for ſome of them have told me, that they have bought the Root which cures the Bite of the Rattle-ſnake from their *Wiochiſt*.

5. Their King allows no Salary, that ever I heard of; but every one that in any Nature can ſerve his Prince, is ready to do it, and to do it *gratis*.

6. They have no Conſultations, their Practice being merely empirical. They know little of the Nature or Reaſon of Things. Ask them any Queſtion about the Operation of a Remedy, and, if in good Humour, perhaps they will reply, *It cures*; otherwiſe, they will ſhrug their Shoulders, and you may ask forty Queſtions, and not know whether they underſtand either the Thing, or what it is that you ſay to them.

7. They pay a certain Deference of Honour to their Prieſt or *Wiochiſt*, whoſe Perſon they hold ſacred; but Laws they have none (as far as I could ever learn) that binds them thereto: In general, the Will of their Prince ſtands for Reaſon and Law.

8. The Means whereby they convey their Art to Poſterity, I take to be this: They lodge in their

*Wiochiſan* Houſes, *i. e.* their Temples, certain kinds of Reliques, ſuch as Mens Skulls, ſome certain Grains or Pulſe, and ſeveral Herbs, which are dedicated to their Gods; *viz.* The Skulls in Memory of their Fights and Conqueſts; the Pulſe by way of Thank-offering for their Proviſions; and the Herbs upon the ſame Account, for ſome ſpecial Cure performed thereby. For when any one is cured by any Herb, he brings Part thereof, and offers it to his God; whereby the Remembrance of this Herb and its Virtue is not only preſerved, but the Prieſt alſo becomes beſt inſtructed thereby, and knowing in the Art of Medicine: For otherwiſe, they are mighty reſerved of their Knowledge, even among themſelves. Whether the Prieſt takes certain Perſons to inſtruct, or teaches only his own Children, I know not. Often when they are abroad hunting in the Woods, and fall ſick, or come by any Hurt, they then are forced to make uſe of any Herbs which are neareſt at Hand, which they are not timorous in venturing upon, though they know not the Virtue or Qualities thereof. And thus, by making many Trials and Experiments, they find out the Virtues of Herbs; and by uſing ſimple Remedies, they certainly know what it is that effects the Cure.

9. They are generally moſt famed for curing of Wounds, and have indeed various very good Wound-herbs, as an Herb commonly called *Indian-weed*, which perhaps may be referred to the *Valerians*, and be ſaid to be *Platani foliis*. They uſe alſo the *Gnafalium Americanum*, commonly called there *White Plantain*. As to our *Plantain*, or the *Heptapleuron*, they call it the *Engliſhman's-foot*, and have a Tradition,

dition, that it will only grow where they have trodden, and was never known before the *Engliſh* came into this Country. The moſt famous old Phyſician among the *Apomatick Indians*, as I was informed by a Perſon of a very good Underſtanding, uſed moſtly an Herb which he ſhewed me, whoſe Leaf is much like *Self-heal* in Winter. I obſerved it was red underneath, and would at length appear tinged on the upper Side alſo: It makes a good Salve, only it fills a Wound too faſt with Fleſh. I took a Draught of this Herb, along with ſome others, which I have left in the North of *England*. The great Succeſs they have in curing Wounds and Sores, I apprehend moſtly to proceed from their Manner of dreſſing them: For they firſt cleanſe them, by Sucking, which, though a very naſty, is, no doubt, the moſt effectual and beſt way imaginable; then they take the *biting Perſicary*, and chew it in their Mouths, and thence ſquirt the Juice thereof into the Wound, which they will do as if it were out of a Syringe. Then they apply their Salve-herbs, either bruiſed or beaten into a Salve with Greaſe, binding it on with Bark and Silk-graſs. Colonel *Spencer*, the preſent Secretary of State of *Virginia*, told me of a very ſtrange and extraordinary Cure performed by an *Indian*, on one of his *Negroes*. The *Negro* was a very good Servant, wherefore his Maſter had valued him much; but by Degrees he grew dim-ſighted, and was troubled with terrible Pains in his Eyes, ſo that with one he could ſee but a little, and none at all with the other; and as the Pain ſtill increaſed, the Colonel was greatly apprehenſive, leſt his *Negro* would be quite blind. Several Surgeons were ſent for, who had tried to cure him, but in vain; when an *Indian*, coming to the Houſe, ſaid he would cure him; they told Mr. Secretary thereof, who ſent for the *Indian*, and agreed with him for two Quarts of Rum. The *Indian* told him, that he could ſave one Eye, but that the *Negro* would be blind of the other. The next Morning the *Indian* went a hunting into the Woods for his Herbs, and returned with them about Noon, which he bruiſed, putting thereto a little Water; and having preſſed forth ſome of the Juice, he dropped ſome thereof into the Eye which he ſaid would be blind, and laid the Herbs thereon, which he would have bound faſt with Bark; but the Colonel called for ſome Linen Rags, and had it bound up therewith. He then intimated to the Colonel, that ſhortly after Sun-ſet the *Negro* would be mad, if his Medicine took Effect, but would come to himſelf again before Morning; wherefore ſtrict Orders were given, that he ſhould be well attended, and that nothing ſhould be altered, let what would happen. All things therefore being accordingly done as the *Indian* had directed, every thing ſucceeded likewiſe as the *Indian* had foretold. Then, about 11 o'Clock the next Day, the Binding being removed, and the Herbs taken off from the Eye, the *Indian* bid the *Negro* hold down his Head, which when he had done, out-dropped the Cryſtaline and aqueous Humours. The *Indian* afterwards bound it up again, and by Degrees the *Negro* was freed from his Pain, and had perfect Sight with the other Eye. What the Herbs were, the Colonel could never learn from him, though he proffered him whatever he would demand.

10. The Diſtempers amongſt the *Engliſh* Natives (for I cannot give ſo particular an Account of the Diſtempers moſt predominant among the *Indians*) are, *Scorbutical Dropſies*, *Cachexies*, *Lethargies*, *Seaſonings*, which are an intermitting Fever, or rather a continued Fever with quotidian Paroxyſms. Theſe are now rarely ſharp, but ſhew themſelves in a lingering Sickneſs. The *Griping of the Guts* moſtly dry, and when the *Tormina Ventris* ceaſe, they generally ſhoot into the Limbs, and fix there, in a terrible ſort of Gout, taking away the Uſe of the Limbs. Thus they will pine away to Skin and Bone, ſo that their Joints will ſeem diſlocated, and their Hands utterly crippled. *Sore Throats*, which the laſt Year were very frequent, and deemed infectious, running generally through whole Families, and, unleſs early prevented, became a cancerous Humour, and had Effects like the *French-pox*. Likewiſe *Pains in the Limbs*, which I apprehend to have proceeded partly from the ſame Humour floating up and down the Body. Theſe Pains are very exquiſite, moſtly nocturnal; for while they walk, if they have the Uſe of their Limbs, they feel the leaſt Pain. The Oil of a Fiſh called a *Drum*, was found very effectual to cure theſe Pains, and reſtore the Limbs. I was Eye-witneſs when a very worthy Gentlewoman, who had loſt the Uſe of her Limbs, was intirely recover'd by the Uſe of this Medicine: For her Feet being anointed with this Oil, the Pains flew into her Head; her Head thereupon being anointed, the Pain deſcended again; then anointing both Head and Feet, ſhe was recover'd. There are three ſorts of Oils in that Country, whoſe Virtues, if fully proved, might

not perhaps be found deſpicable: The Oil of *Drums*, the Oil of *Rattle-ſnakes*, and the Oil of *Turkey Buſtards*. The Oil of *Saſſafras-leaves* may be deſervedly conſider'd too, for they will almoſt intirely diſſolve into an Oil. But to return: There is another ſort of Diſtemper, which I judge to be the *Lepra Græcorum*. And it may perhaps be no bad Conjecture, that this chiefly proceeds from their feeding ſo much as they do, on a delicate luſcious ſort of Pork. Among the *Indians* they have a Diſtemper which they call the *Yaws*, which is nearly related to the *French-pox*; which they are ſaid to cure with an Herb that fluxes them: But this I have only by Hear-ſay.

11. The *Indians* mind neither the Pulſe nor Urine, only judge by the common moſt remarkable Symptoms; and ſome pretend to form a Judgment from the Countenance, and are fond of being thought Phyſiognomiſts.

12. I never could find, that they practiſed the *letting of Blood*. They purge much with ſeveral ſorts of Roots of their own Country Growth, and vomit frequently with various Herbs. They ſweat boldly and exceſſively, and after a very ſtrange manner: For they have their Sweating-ſtoves always upon the Bank of ſome River; whence they ruſh forth in the Height of their Sweat, and run into the River, where they waſh and bathe themſelves very plentifully. They uſe no *Bliſtering-plaiſters*, but are exquiſite at Cupping. As the *Eaſt-Indians* uſe *Moxa*, ſo theſe burn with *Punk*, which is the inward Part of the Excreſcence or Exuberance of an *Oak*. When they deſign to give a *Purge*, they make uſe of the following

ing Herbs: *Poake-root*, i. e. *Solanum bacciferum*, a ſtrong Purge, and by moſt deemed Poiſon. The Roots of *Tythimal*, of which I have obſerved two ſorts; the one *Flore minimo herbaceo*, the other *Flore albo*. The Flower of this laſt is ſmall, but large in Compariſon with the other: They are *repentes*, and grow in old manured Grounds. They chiefly make uſe of the latter of theſe, and it is a moſt excellent Purge, though it ſometimes vomits: It is a quick, but moderate Worker enough; and has this Peculiarity, that it opens the Body in the *Gripes*, when other much violenter Purgatives will not move it. There is another Herb, which they call the *Indian Purge*: This Plant has ſeveral woody Stalks growing near three Feet tall, and, as I remember, *perfoliat*: It bears yellow Berries round about the Joints: They only make uſe of the Root of this Plant. They uſe alſo the *ſmall Fleur de Lis*, whoſe Virtues, I believe, are not yet half known, for it has ſome extraordinary Qualities: It does not grow above a Hand high, flowers in *March*, and is very fragrant. They uſe alſo ſome ſort of the *Apocynum's*; particularly that which I think *Gerard* calls *Vincetoxicum Americanum*; for there are ſeveral ſorts of *Apocynum's*, I think 13 or 14, but they are not all purgative: For having got ſome of the Root from an *Indian*, which he aſſured me was the *Rattle-ſnake-root*, I thought the Root of an *Apocynum* (which may well be diſtinguiſhed by that of *Roſæ Mariæ foliis*) was very like it, both in Shape and Taſte, conſidering the one dried, and the other freſh: Wherefore I got ſome Quantity thereof, and carrying it in my Pocket, I ventured to eat thereof, little by little, till I believe I have taken a Drachm at a time, to obſerve if it had any peculiar Operation on the Body; but could never find, that it had.

They have likewiſe ſeveral ſorts of Herbs, wherewith they *vomit*; one of which is a little ſort of *Squills*. They likewiſe take the Leaves of a certain curious odoriferous Shrub, that grows in the Swamps, which I take to be the *leſſer Saſſafras*; they bruiſe them in Water, and then expreſs the Juice, which they drink warm. The *Indian* Interpreter, who taught me this, prized it much, as excellent Phyſic, and ſaid they found it a very ſovereign Remedy. It is as odoriferous as any Shrub I ever ſmelt at in my Life: Whoever has once taken Notice of the Smell, cannot forget it, or be deceived therein afterwards, having ſomething peculiar in it. The Name which the *Indian* gave me hereof was *Wiſochis*, which ſince I underſtand is the general Word for Phyſic.

13. The reſt of their *Materia Medica* conſiſts of Herbs, of which they have great Plenty, and ſeldom preſcribe any thing elſe. I have collected above 300 ſeveral ſorts, that were no *European* Plants; but I ſhall only mention thoſe at preſent, whoſe Virtues I take to be moſt remarkable. And firſt, the *Saſſafras-tree*, whoſe Root is well enough known. It ſhoots forth its Bloſſoms in *March*, which are yellow, and grow in little Bunches like Grape-flowers, and which, when gathered and picked from the husky Bud, make a curious Preſerve. Moſt *Saſſafras-trees* bloſſom, few bear Berries, but thoſe that do are generally very thick: They are ſhaped much like thoſe of *Dulcamara*, but are black of Colour, and very *aromatic*; I take them to have conſiderable Virtues.

The *Gum-tree*, which I refer to the Species of Plane-trees, and diſtinguiſh it by its Fig-like Leaf, only more ſharply dented. Its Leaf ſmells much like a Lemon. Their Practice is to beat the Tree, and then pill off the Bark, and ſo ſcrape the Gum, which has Virtues like Turpentine, or rather more aſtringent and drying. This they uſually mix with their common Turpentine, which is whiter and more Butter-like, than the *Venice* or *Chios* Turpentine. *Quære*, whether better or no? The further Method of preparing this Medicine, as I am told, is this: They expoſe it to the Sun on Paper, where at firſt it rather ſeems to melt, but it will afterwards grow hard; they then beat it to a Powder, and adminiſter it. They uſe much the young Buds of the *Populus, ſive Tulippa arbor*, a vaſt large Tree, extraordinary ſpacious, bearing Flowers about *April*, much like Tulips; its Leaves are large, ſmooth, and well-ſhaped, which, together with the Flowers, render the Tree exceeding beautiful to behold. It bears its Seed coniferous, and is an excellent Opener of Obſtructions. The *Sorrel-tree* bears a Leaf ſomething like a Laurel, in Taſte much reſembling *Lujula*. They uſe it in Fevers, and, as I am informed, with good Succeſs. This Tree grows plentifully on the South-ſide of *James* River in *Virginia*; I cannot ſay I ever found it to the Northward. The *Swamp-plum-tree*, whoſe Wood they calcine, and make into Charcoal, which they beat to a Powder, then mix it with Greaſe, and make an Ointment thereof, with which they anoint the Body, and foment it very much, whereby they cure the *Dropſy*; for it opens the Pores to that Degree, that the Water runs down their Legs. Among their Herbs, I have had 40 ſeveral Sorts, or near that Number, ſhewed me as great Secrets, for the *Rattle-ſnake-root*, or that kind of *Snake-root* which is good for curing the Bite of the *Rattle-ſnake:* But I have no Reaſon to believe, that any of them are able to effect the Cure. One Gentleman ſhewed me a certain Root, which was a *Smilax*, and aſſured me, that that was certainly the *Rattle-ſnake-root*. And afterwards, when I ſhewed Mr. Secretary *Spencer* the ſame Root, he ſaid that certain *Indians* had given him of the ſame Root for the *Rattle-ſnake-root*, and that he had ſome Quantity to ſend for *England*; but this Root is by no means the ſame with that which I have mentioned before, in Anſwer to *Quære* 12. which I ſaid was like the Root of an *Apocynum*, which I myſelf obtained from an *Indian*, who ſeemed to prize it highly, having ſewed it carefully up in Leather, on the Inſide of his Belt. Others have ſhewed me *Chryſanthemum ferulaceis foliis* for it; others *Chryſanthemum tragopyri foliis*. Again; general Report goes in favour of the *Aſarum Cyclaminis foliis*, which many therefore particularly call *Rattle-ſnake-root*. There are ſtrange Stories told in favour of an Herb called *Dittany*, which however is not of the *Dittany* kind, but is only a Mountain *Calaminth*. This, they ſay, will not only cure the Bite of a *Rattle-ſnake*, but that the Smell thereof will kill the *Snake*. But however, * I have ſome Reaſon to believe, that this Herb will not cure the Bite, nor that the Smell thereof will kill the

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* See *Miſcel. Curioſa*, Vol. III. p. 352.

*Snake*; for Colonel *Spencer* aſſured me, that he had an Opportunity of making an Experiment thereof upon a Dog which was bitten by a *Rattle-ſnake*, to which he gave plentifully of the Juice of his *Dittany*, as they called it; but the Dog died nevertheleſs a Day or two after. And Mr. *Wormley*, one of the Council of State in *Virginia*, told me, that being in Company with another Gentleman, he had an Opportunity of making the following Experiment; for ſeeing a *Rattle-ſnake* in her Coil, they went and got a Bunch of this *Dittany*, and tied it to a Pole; then putting the *Dittany* that was thereon to the Noſe of the *Snake*, it ſeemed to offend her, whereupon ſhe turned away her Head, which they ſtill followed with the *Dittany*; then the *Snake* fled, and they ſtill purſuing her, ſhe at laſt ſtretched herſelf out at Length, and lay ſeemingly dead. Then they laid the *Dittany* upon her Head, and went into a neighbouring Houſe to refreſh themſelves; for they were tired with skipping about after the *Snake*. When they had ſtaid near half an Hour, they returned to ſee their ſuppoſed dead *Snake*; but, behold! the *Snake* was fled; ſo that they then judged, that the *Snake* had only ſtretched herſelf out, becauſe ſhe had been tired with their Purſuit. I look upon it probable therefore, that ſome Accident of the like kind may have firſt given Origin to this Story; the Perſon who had tired the *Snake* not having regularly waited for the Event, but perhaps, to ſecure the Conqueſt, may have given the *Snake* a Stroke with a Switch upon the Back (which would have killed the *Snake* without the *Dittany*). But yet nevertheleſs, this Plant is of more than ordinary Virtues, and might not unprofitably be uſed by our Phyſicians. It may be referred to the Claſs of the *Calamintha montana, pulegii odore*, which has been transferred from thence into *England*, and I think is now pretty common, but is hotter, and more ſudorific.

I will now mention to you an Herb, though unknown, yet worthy to be fetched from *Virginia*, yielded the Country nothing elſe: It is the Herb called there *Angelica*, but which I take to be *Libanotis vera latifolia Dodonæi*. It grows generally on a rich ſandy Ground, on a declining Brow, that faces the riſing Sun; the Root ſhoots deep into the Earth, ſometimes near three Feet, very tender, and eaſily broken, of a white or rather Cream-like Colour; and being lacteſcent, yields a little Milk, thick and yellow as Cream; a very early Plant. It ſeldom flowers or ſeeds under five Years Growth; for I have fully and diſtinctly obſerved that Number of Years in the ſeveral Sorts of this Plant, by the Growth of thoſe not come to Maturity to bear Seed; and it is obſervable, that thoſe which do not ſeed, have rarely more than one Branch, which divides when it ſpreads, and ſubdivides itſelf ſtill into Three. The Leaf is much like our wild *Angelica*, only thinner, and more the Colour of a Willow-green. Thoſe that ſeed, have a fiſtulous Stalk about the Thickneſs of *Dill*, a white umbelliferous Plant; the Seeds are much like *Angelica ſeed*, but from the Fragrancy of the Root, and its being peculiarly bearded, I undoubtedly ſtyle it a *Libanotis*. It ſtops the *Flux*, and cures it to a Wonder. Again; it often looſens and purges the Bodies of thoſe that are bound, and have the Gripes, eſpecially if it proceeds from Cold; and prevents many unhappy Diſtempers. I have Reaſon to ſpeak well of it; for it is to it, under GOD, that I attribute the ſaving of my own Life. I have known it give 14 or 15 Stools, whereas it will not move a Child in Health. I take it to be the moſt ſovereign Remedy the World ever knew in the Griping of the Guts, and admirable againſt Vapours. It is ſudorific, and very aromatic, and will not be concealed; for whereever it is mixed, it will have the predominant Scent. It is moſtly called by thoſe who know it in *Virginia*, by the Name of *Angelica*: But ſhewing a Piece of the Root to a great Woodſman, to ſee whether he knew it, and could tell me where it grew, he ſeemed ſurpriſed to ſee me have thereof; and told me, that he kept an *Indian* once for ſome Weeks with him, becauſe he was an excellent Woodſman, and going a hunting, (*i.e.*) ſhooting, they came where ſome of this Root grew: The *Indian*, rejoicing, gather'd ſome of it, but was very careful to cut off the Top of the Root, and replant it: He then asked him, Why he was ſo careful? Whereunto the *Indian* replied, It was a very choice Plant, and very ſcarce; for they ſometimes travelled 100 or 200 Miles without finding any of it. He then asked him, What Uſe it was of? To which the *Indian* anſwered, You ſhall ſee by-and-by. After ſome time, they ſpied four Deer at a Diſtance; then the *Indian*, contrary to his uſual Cuſtom, went to Windward of them, and ſitting down upon an old Trunk of a Tree, began to rub the Root betwixt his Hands; at which the Deer toſſed up their Heads, and ſnuffing with their Noſes, they fed towards the Place where the *Indian* ſat, till they came within eaſy Shot of him; whereupon he fired at them, and killed a large Buck. The Truth of this Story I no further aſſert, than that I was told it by a Perſon of ſeeming Seriouſneſs, who had no Inducement to tell a Lye, or impoſe upon me: But I have often taken Notice, that the *Indians* ſmell generally ſtrong of this Herb. And I have ſince learned from others, that the *Indians* call it the *Hunting-root*, which makes me more inclinable to give Credence to this Story. Another Gentleman, a white Native of that Country, when I once pulled a Piece of the Root out of my Pocket to bite thereof, (for I frequently carried ſome of it about me) asked me, If I loved Fiſhing? I required, Wherefore he asked me that Queſtion? Becauſe, ſaid he, you have gotten ſome of the *Fiſhing-root*. The *Fiſhing-root!* replied I; pray why do you give it that Name? Becauſe, ſaid he, when we were Boys, we uſed to get ſome of it to lay with our Baits to invite the Fiſh to bite. This I can ſay of my own Knowledge, that having one Day got ſome Quantity of the Root, and likewiſe of the Branches, to diſtil, the ſtrong Scent, as I went home, palpably put me into a breathing Sweat. In the Night I was waked by a Rat, which ran over my Face, whereas I never at any other time had the like happen to me; but will not be poſitive to conclude, that this Root was the Cauſe thereof, only the precedent Relations made me reflect thereon. There is another Root of the Species of *Hyacinths*, the Leaves whereof are graſs-like, but ſmooth and ſtiff, of a willow-green Colour, and ſpread like a Star upon the Ground; from the Middle ſhoots a tall long ruſh-like Stem, without Leaves, near two Feet high; on one Side grow little white Bell-flowers one above another: The Root is black outwardly, but brown within. It is bitter, and I take it to have much the ſame Virtues as *Little Centaury*. Some call it *Ague-graſs*, others *Ague-root*, others *Star-graſs*. I have likewiſe been told by ſeveral, of a Root which the *Indians* cure Bruiſes wonderfully with; but I apprehend it is the ſame Root with which the *Indian* cured the *Negro's* Eye afore-mentioned; for it operates much after the ſame manner, according to their Relation, making the Patients mad for ſome Hours, if they be recoverable. It is not to be applied where the Skin is broken. They uſe it thus: They chaw ſome of the Root in their Mouths, and then ſquirt it forth on the bruiſed Part, fomenting it well with their Hands; then they give a little to the Perſon bruiſed to chaw, who muſt ſwallow the Juice, but ſpit forth the Root again, which they bind on the Part aggrieved. If the Relations I have had of Cures performed thereby, be abſolutely true, the World has not yet diſcovered a more wonderful Remedy. I had it deſcribed to me by Colonel *Smith*, of the *Iſle of Wight County*, to be like *Langue de Bœuf*, with a yellow Flower, and rough hoary Leaf, the Root yellowiſh, and taſted ſomething ſweetiſh like Liquorice. There are ſeveral others I might name, whoſe Virtues are by no means deſpicable; ſuch as the *Chryſanthamum platani foliis*, whoſe Root is very uſeful in *old Pains*, the *Sciatica* and *Gout*. It is a large Herb, grows betwixt five and ſix Feet tall. There are likewiſe many others, which bear ſome Analogy to the *European* Plants, ſuch as *Solomon's-ſeal*, *Wood ſage*, much better, I think, than the *Engliſh*; which the *Indians* uſe much for Infuſions, and which they take as we do Diet-drink. *Little-Centaury*, red, white, and yellow, *&c.* However, I never could find above 12 or 14 Plants, which were Natives of that Country, that agreed perfectly with any of our *European* Plants, but what had ſome notable Differences, if they were not rather to be reckoned a diſtinct Genus.

13. There go Traditions of their having an Art to poiſon their Darts; but I could never find any ſolid Grounds for that Report. I have obſerved, that in thoſe Countries, upon an ill Habit of Body, the leaſt Scratch is dangerous; and that, for all the Care that can be taken to prevent it, it often turns into a very deſperate ulcerous Sore. Some Herbs there are of an analogous Nature with *Hemlock*, whereof, I think, they know nothing further, than that they are to avoid them; but any Herbs, wherewith they poiſon their Darts, I never could hear ſpecified. And as Perſons engaged in long Marches are liable to many Accidents, which may contribute to an ill State of Health, when a ſlight Wound in Battle has then proved mortal; this I apprehend to have been the Cauſe, why the Phyſician has rather choſen to attribute the Death of his Patient to the Poiſon of the Dart, than the want of Skill in himſelf.

14. As to their Morals, they are ſimple and credulous, rather honeſt than otherwiſe, and unpractiſed in the *European* Art of Lying and Diſſimulation; but as to the brutal Paſſions, they are ſottiſh and ſenſual as the Beaſts of the Field.

15. They are almoſt always either eating or ſleeping, unleſs when they go a hunting: At all Hours of the Night, whenever they awake, they go to the *Homing-pot*, that is, Maze dreſſed in a manner like

our pilled Wheat; or elſe a Piece of Veniſon *barbecuted*, that is, wrapped up in Leaves, and roaſted in the Embers.

16. They drink, I think, little beſides *Succahannah*, that is, fair Water, unleſs when they can get Spirits, ſuch as Rum, from the *Engliſh*, which they will always drink to Exceſs, if they can poſſibly get them; but do not much care for them, unleſs they can have enough to make them drunk; and I have heard it ſaid, that they wonder much at the *Engliſh* for purchaſing Wine at ſo dear a Rate, when Rum is much cheaper, and will make them ſooner drunk.

17. They uſe *Tobacco* much, which they ſmoak in ſhort Pipes of their own making, having excellent Clay, which I tried a little before I came for *England*, making Crucibles thereof, which I could not diſcern were inferior to the *German*. They make alſo neat Pots of the ſame Clay, which will endure the Fire for any common Uſes.

18. They have no *Opium*, though in ſome old Fields upon *York River*, I found Poppies perhaps of no deſpicable Virtue. I have been told, that in Fevers, and when their Sick cannot ſleep, they apply the Flowers of *Stramonium* to the Temples, which has an Effect like *Laudanum*. I have had aſſerted by many, that when the Soldiers were ſent over to quell the Inſurrection of *Bacon*, *&c.* they being at *James-town*, ſeveral of them went to gather a Sallad in the Fields, and lighting in great Quantities on an Herb called *James-town-weed*, they gathered it; and by eating thereof in plenty, were rendered apiſh and fooliſh, as if they had been drunk, or were become Idiots. Dr. *Lee* likewiſe aſſured me, that the ſame

Accident happened once in his own Family; but that after a Night or two's Sleep, they recovered.

19. Their *Sports* are Dancing, their *Games* are playing with Straws, which as I am not perfectly acquainted with, I find it hard to deſcribe; I can therefore only tell you how it appears to a Looker-on: They take a certain Number of Straws, and ſpread them in their Hands, holding them as if they were Cards; then they cloſe them, and ſpread them again, and turn them very ſuddenly, and ſeem very dextrous thereat. Their *Exerciſe* is Hunting, that is, Shooting with a Gun, or with Bow and Arrow, wherein they excel. Their Women work, plant the Corn, and weave Baskets or Mats.

20. Several have been very old; I cannot ſay, that herein there is any remarkable Difference between them and the *Engliſh* Natives. If the *Engliſh* live paſt 33, they generally live to a good Age; but many die between 30 and 33.

21. I have been told, that one of their famous *Wiochiſts* propheſied, that bearded Men (for the *American Indians* have no Beards) ſhould come and take away their Country, and that there ſhould none of the original *Indians* be left within a certain Number of Years, I think it was an Hundred and Fifty. This is very certain, that the *Indian* Inhabitants of *Virginia* are now very inconſiderable as to their Number; and ſeem inſenſibly to decay, though they live under the *Engliſh* Protection, and have no Violence offered them. They are undoubtedly no great Breeders.

22. Though they are ſluggiſh by Nature, and ſlow of Speech, yet their Method of Expreſſion ſeems ve-

vehement and emphatical, and always attended with ſtrong Geſticulations. They are generally well proportioned, and for the moſt part are rather taller than the *Engliſh*. They have all either a very dark-brown Hair, that may well be called black, or a Jet-black, all lank.

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## II. *An* Experiment *to prove, that* Water, *when agitated by* Fire, *is infinitely more* elaſtic *than* Air *in the ſame Circumſtances; by the late Rev*<sup>d</sup> John Clayton, *Dean of* Kildare *in* Ireland. *Communicated by the ſame Hand as the preceding.*

SIR *Thomas Proby* having heard of a new Digeſter, which I contrived, had a Deſire to ſee it, and ſome Experiments made therein. I had a ſmall one, which I deſigned only for an inward Cylinder; this I could eaſily put in my Pocket: Wherefore, going to pay him a Viſit at *Elton* in *Huntingdonſhire*, I took it along with me; and having ſoftened a Bone therein in a very ſhort Space, he was deſirous to know the ſhorteſt Time it was poſſible to ſoften a Bone in: I told him, I thought I could ſoften the Marrow-bone of an Ox in a very few Minutes, but that that Veſſel was very weak, and I feared would not endure the Preſſure of ſo violent a Heat; yet ſeeming deſirous to have the Experiment tried, I ſaid I was ready to venture my Veſſel: Then having fixed all things right, and included about a Pint of Water, and, I believe, about ℥ij of a Marrow-bone, we placed the Veſſel horizontally betwixt the Bars of the iron Grate into the Fire about half way; and in three Minutes time I found it raiſed to a great Heat; whereupon I had a mind to have taken it out of the Fire, leſt it ſhould have burſt; telling Sir *Thomas* of the Danger that I apprehended: For I remember'd, that the Screws of a Digeſter, made after Mr. *Papine's* Method, giving way, the Head flew one way and the Screws and Irons another, with ſuch Violence, that the Head, having hit againſt a Brick, cut a Piece clearly out of it; which was one Reaſon and Motive to my contriving a Digeſter this way, that the Screws cannot poſſibly ſtart, but that the Veſſel would ſooner break in any other Part: But in this (I added) I thought the Bottom would firſt burſt, it being only ſoldered in. Scarce had I done ſpeaking, and Sir *Thomas* thereupon moved his Chair to avoid Danger; but ſeeing the Heat become more raging, I ſtepp'd to the Side-table for the Iron wherewith I managed the Digeſter, in order to take it out of the Fire, when, on a ſudden, it burſt as if a Muſquet had gone off. A Maid that was gone a milking, heard it at a conſiderable Diſtance; the Servants ſaid it ſhook the Houſe. As I had foretold, the Bottom of the Veſſel, that was in the Fire, gave way; the Blaſt of the expanded Water blew all the Coals out of the Fire all over the Room; for the Back of the Fire-range was made juſt like an Oven, ſo that circulating therein, it brought forth all the Coals at the Mouth thereof. All the Veſſel together flew in a direct Line croſs the Room, and hitting the Leaf on a Table made of an inch Oak-plank, broke it all in Pieces, and rebounded half way of the Room back again. What ſurpriſed me in this Event was, that the Noiſe it made at its burſting was by no means like the ſucceſſive evaporating of an Æolipile, but like the firing off of Gunpowder. Nor could I perceive any-where in the Room the leaſt Sign of Water, though I looked carefully for it; and, as I ſaid before, I had put a Pint into the Digeſter, ſave only that the Fire was quite extinguiſhed, and every Coal belonging to it was black in an Inſtant.

But to confirm the Elaſticity of Water, or to ſhew, at leaſt, that there is a much ſtronger elaſtic Force in Water and Air, when jointly included in a Veſſel, than when Air alone is incloſed therein, I made the following Experiment: I took two ℥vj Phials, into the one I put about ℥v of Water, or better, and ſo corked it as well as I poſſibly could; the other I corked in the ſame Manner, without putting any thing into it. I incloſed them both in my new Digeſter, Four-fifths being filled with Water; when the Heat was raiſed to about Five-ſeconds, I heard a conſiderable Exploſion, and a jingling of Glaſs within the Veſſel, and ſhortly after another Exploſion, but not ſo loud as the former; whence I concluded, that both the Phials were broken. I then let the Digeſter cool leiſurely, and the next Day I opened it; both the Corks were ſwimming on the Top of the Water, but only one of the Phials was broken, *viz.* that one into which I had not put any Water. At firſt, indeed, I concluded, that the Preſſure or Dilatation of the Air in the empty Phial being ſtronger than the ambient Preſſure, forced forth the Cork, whereupon the Water, ruſhing in with Violence, might break the Phial; and therefore that this was the Cauſe alſo of the Loudneſs of the Exploſion; whereas the other being moſtly filled with Water, there being but a ſmall Quantity of Air therein, juſt enough to force out the Cork, the Phial was not broken, but was preſerved by the Force of the Water incloſed therein. But I have had Reaſon ſince to change my Opinion; for having had very ſtrong Phials made, on Purpoſe to make ſome peculiar Experiments therewith, I took one of them, and having filled it about a quarter full with Water, and corked it very well, I ſet it in a ſquare iron Frame, with a Screw to ſcrew down the Cork, and keep it from flying forth. I then put it into a Digeſter, Four fifths filled with Water; which being heated to a due Height, when I opened it, I found the Cork forced into the Phial, though the Cork was ſo very large, that it amazed ſeveral who ſaw it, to conceive how it was poſſible for ſo large a Cork to be forced into the Bottle. Hence it manifeſtly appears, that the Preſſure in the Digeſter, wherein was proportionately more Water, and leſs Air, was ſtronger than the Preſſure within the Phial, wherein was proportionately more Air, and leſs Water. Then I reaſon'd thus alſo of the two former Phials: That the Air in the Phial, wherein was no Water included, making not a proportionate Reſiſtance to the ambient Preſſure in the Digeſter, wherein was a conſiderable Quantity of Water, the Cork was forced inward with ſuch Violence, that it, together with the Water, daſhed the Phial in pieces; but that in the other Phial, wherein there were Five-ſixths of Water, the inward Preſſure in the Phial being greater than the ambient Preſſure in the Digeſter, wherein were but Four-fifths of Water, the Cork was thereby forced outward; and that the ſmall Difference between the proportionate Quantity of Water and Air in the Phial and in the Digeſter, being only as Four-fifths to Five-ſixths, was the Reaſon not only why the Bottle was not broken, but alſo of the Faintneſs of the Exploſion.

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## III. *Part of a Letter from* John Green, *M. D. Secretary of the* Gentlemens Society *at* Spalding *in* Lincolnſhire, *to* C. Mortimer, *M. D. Sec.* R. S. *ſerving to incloſe a Relation of a* Girl *three Years old, who remained a Quarter of an Hour* under Water *without drowning.*

*SIR*, *Spalding, Feb.* 18. 1737-8.

THE incloſ'd is what I receiv'd this Day from a Gentleman who lives on the Spot, and what you in yours ſo much deſir'd. The Reaſon of the Child's being able to abide ſo long under Water is pretty evident: The Child, moſt likely, was infirm, weak, and ſickly, from the Time of her Birth, ſo that the *Foramen Ovale* was not grown up. I remember about three Years ago to have ſeen a Subject, an old Woman 80 Years old, who had the *Foramen Ovale* ſo large, that you might eaſily thruſt your middle Finger through it; but ſhe was attended with the above-mention'd Circumſtance, that is, ſhe never enjoy'd a Moment's Health in her Life.

*May* 16. 1737. *Rebecca Yates*, of *Billſon* near *Market-Boſworth* in *Leiceſterſhire*, had a Daughter about three Years of Age, that fell into the Mill-dam at the Head, near to the Mill-wheel; and, by the Force of the Stream, was drawn under the Water to the ſaid Wheel, with her Legs forwards; one of her Legs went under the Mill-wheel, and by reaſon of the Nearneſs of the Wheel to the Floor of its Water-way, the Bulk of the Child's Leg ſtopped the ſaid Wheel from moving at all. The ſudden ſtopping of the Mill ſo much ſurpriſed the Miller, that he went immediately, and let down the Shuttle; but finding it would not go quite down, he came up again into the Mill, and looked both above and below, to ſee if he could not find out the Cauſe; then went and drew up the Shuttle, and let it down again; but as the Gate would not ſhut quite down, he could not as yet find out the Cauſe of his Mill ſtanding ſtill; for which Reaſon he went backwards and forwards betwixt the ſaid Shuttle and Mill-room, as nigh as he can gueſs, Eight or Ten times, before he found out the Cauſe; but at laſt he drew the Shuttle quite up, by which means the Force of the Water drove the Child from under the Shuttle; then he put the Shuttle quite down, and thereby diſcover'd the Child with her Leg under the Wheel, and lying upon her Face. The firſt Word ſhe ſpoke was, *Help me*, which ſhe repeated three times; the Miller left her Arm for ſome other Perſon to hold her, whilſt he endeavour'd to remove the Wheel, ſo as to get out her Leg; and then ſhe ſaid again, *For God ſake help me out, if* *you can:* She ſpoke very briskly, after ſhe was put to Bed. But the Mill-wheel had tore away all the Shin, Muſcles, Sinews, and Tendons, of her Leg, quite to the Bone, and ſtript them down to her Heel; beſides, the Shuttle was drawn up and let down upon the Small of her Back ſeveral times. The Child lived from *Monday* till *Friday*, and then died of her Wounds and Bruiſes; otherwiſe, in all Appearance, ſhe might have lived to have made a fine Woman. The whole Time of her being under Water (and that at the Depth of four Feet and an half) was near 15 Minutes. *Atteſted by*

John Bailey, *Miller.*
Rebecca Yates, *the Mother.*
*The Mark* + *of* Grace Cooper,
*the Miller's Maid.*

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## IV. *The Caſe of Mr.* . . . . Cox, *Surgeon at* Peterborough, *who fell into a* Peſtilential Fever, *upon Tapping a* Corpſe *lately dead of an* Hydropſy, *drawn up by himſelf, and read before the* Peterborough Society, Sept. 1. 1736. *communicated to the* ROYAL SOCIETY *by the Rev$^d$ Mr.* Tim. Neve, *Sec. Soc.* Petroburg.

AN elderly Gentlewoman, labouring of a Dropſy about 12 Months, underwent the Operation of Tapping four ſeveral times, by which 35 Quarts of Liquor were diſcharged; and dying at laſt of the ſame Diſtemper, I was deſired by her Friends to let out the Water that was then contain'd in the *Abdomen,* as well to preſerve the Corpſe the longer from Putrefaction, as to prevent an Annoyance to the Company at the time of her Funeral.——Yet notwithſtanding this was done within a few Hours after Death, the included Humours were arriv'd to ſuch a Pitch of Putrefaction, as to diſcolour the external Parts with a green and livid Hue.——The Liquor itſelf was green, and ſomewhat thicker than new Milk, in Smell more fetid and offenſive than what I ever met with, and ſo ſharp and acrimonious in its Nature, as deeply to corrode a ſilver Canula, through which it paſſed.——And what ſhew'd it to be highly malignant, may be judged of from the following Circumſtances.

The Night after the Operation, I was ſomewhat reſtleſs and uneaſy, and the next Day afflicted with ſmall Tremors, and an unuſual Laſſitude; in about three Days after, ſeveral angry Puſtles aroſe upon my Hands and Fingers, and I believe on every Place where the leaſt Drop of Water fell; ſome of which coming to Matter, went off ſoon; thoſe which did not, continued painful, and remained much longer. ——The Thumb of my Right Hand, and middle Finger of my other, were affected more ſeverely than any other Part, the Pain more exquiſite, the Swelling more hard and large, and of a red dusky Complexion. This was about the 6th Day of my Illneſs, and altho' the ſtrongeſt Suppuratives were made uſe of, yet they fail'd of the deſir'd Succeſs, the Pains being continual.——Being perſuaded from the great Pulſation and heavy Pains I underwent, that Matter muſt lodge either under or upon the *Perioſteum*, an Inciſion was made to the Bone, by which only two or three Drops of Matter were diſcharged.——'Twas expected this ſmall Diſcharge might in ſome meaſure mitigate my Pain, but it did not; the ſame Evening, that Pain I at firſt complain'd of was changed into univerſal Convulſions, and the Oppreſſion upon my Vitals ſo great, as to threaten immediate Death.

The Intentions of Cure (which were ſtrictly attended to, by my ingenious Friend Dr. *Charles Balguy*) were to fortify the Heart with Cordials, to enable it to reſiſt and throw out the Malignity, and to bring the Sores to a plentiful Digeſtion.

The firſt was treated with the higheſt Alexipharmacs, the latter, as at firſt, with ſtrong Suppuratives: This being about the eighth Day of my Illneſs, and the Convulſions continuing, with an unequal and low Pulſe, and as there was little Appearance of Matter, Bliſters were plentifully applied, as near to the Parts affected as poſſible, in order to make a Revulſion from the Heart, and throw off the morbid Matter by the Wounds. In about three Days this Point was gain'd, the Convulſions began to abate, and the Wounds digeſt; in four more, I found a Ceſſation of Symptoms, except a Faintneſs and Lowneſs of Spirits, which hung upon me for a great while after, which peſtilential Fevers (as this was judged one in an high Degree) are known always to leave behind them.

I ſuppoſe I might receive this Infection as much by Inſpiration as Contact; for ſome of my Aſſiſtants, who were in the Room only, and never touched one Drop of the Liquor, found themſelves much diſorder'd, der'd, and afterwards broke out with red and livid Eruptions; which ſufficiently ſhew'd, that not only the Liquor itſelf, but the *Effluvia* too, were in the higheſt Degree ſubtle and malignant.

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## V. *The* Variation *of the* Magnetic Needle, *as obſerved in Three Voyages from* London *to* Maryland, *by* Walter Hoxton.

*N. B.* The Longitude is reckon'd from the *Lizard*.

### *The Firſt Voyage* 1732.

| Latitude. North. ° | ' | Longitude. Weſt. ° | ' | Variation. Weſt. ° | ' | |
|---|---|---|---|---|---|---|
| 39 | 53 | 27 | 16 | 12 | | In Sight of the Iſland *Corvo* Difference of Longitude from it 35 Minutes Weſt. |
| 37 | 49 | 27 | 45 | 14 | | |
| 35 | 19 | 39 | 20 | 13 | | |
| 32 | 40 | 50 | 27 | 8 | | |
| 34 | 40 | 56 | | 6 | 30 | |
| 35 | 4 | 65 | | 4 | 28 | |
| 36 | 50 | | | 4 | 42 | Diſtance from Cape *Henry* ſeven Leagues. |
| | | | | 4 | 58 | In the Bay of *Cheſepeack*, three Miles below the Mouth of *Potomack* River. |
| | | | | 4 | 47 | Off the Mouth of *Potuxon* River. |

*Return.*

## *Return.*

| Latitude. North. | | Longitude. West. | | Variation. West. | |
|---|---|---|---|---|---|
| ° | ' | ° | ' | ° | ' |
| 36 | 11 | 56 | 20 | 9 | 22 |
| 34 | 52 | 53 | | 6 | 17 |
| 34 | 33 | 52 | | 6 | 15 |
| 34 | 45 | 51 | | 6 | 5 |
| 34 | 36 | 50 | | 6 | 23 |
| 36 | | 49 | 30 | 7 | 37 |
| 37 | 20 | 48 | | 9 | 23 |
| 38 | 4 | 48 | 30 | 10 | |
| 39 | 27 | 47 | 40 | 10 | 23 |
| 40 | 8 | 45 | 40 | 10 | 38 |
| 40 | 30 | 45 | | 13 | 4 |
| 42 | 32 | 42 | 20 | 11 | 43 |
| 42 | 40 | 42 | | 12 | 39 |
| 43 | 27 | 40 | 20 | 13 | 24 |
| 43 | 32 | 39 | 50 | 13 | 42 |
| 49 | 48 | 9 | | 16 | 30 |

## *The Second Voyage* 1733.

| Latitude. North. | | Longitude. West. | | Sun's Alti-tude. | Variation. West. | |
|---|---|---|---|---|---|---|
| ° | ' | ° | ' | | ° | ' |
| 48 | 12 | 3 | 18 | 31 | 18 | |
| 46 | 7 | 4 | 30 | 25 | 16 | 35 |
| 44 | 4 | 7 | | 22 | 16 | 22 |
| 42 | 17 | 9 | | 33 | 16 | 36 |
| 40 | | 12 | | 37 | 15 | 38 |
| 38 | 5 | 14 | 20 | 41 | 14 | 51 |

| Latitude. North. | | Longitude. West. | | Sun's Altitude. | Variation. West. | | |
|---|---|---|---|---|---|---|---|
| ° | ′ | ° | ′ | | ° | ′ | |
| 37 | 36 | 14 | 45 | 25 | 13 | 24 | |
| 36 | 32 | 15 | 52 | 47 | 13 | 17 | |
| 36 | 16 | 16 | 12 | 19 | 13 | | |
| 34 | 2 | 21 | 51 | 35 | 11 | 34 | |
| 34 | 4 | 23 | 18 | 27 | 9 | 51 | |
| 35 | 6 | 30 | 33 | 21 | 10 | 28 | |
| 35 | 12 | 31 | 38 | 20 | 9 | 48 | |
| 34 | 23 | 31 | 22 | 32 | 10 | 23 | |
| 33 | 34 | 32 | 25 | 20 | 8 | 18 | |
| 30 | 19 | 31 | 26 | 23 | 7 | 12 | |
| 29 | 17 | 31 | 11 | 24 | 6 | 45 | |
| 32 | 24 | 37 | 55 | 25 | 6 | 39 | |
| 32 | 50 | 38 | 35 | 25 | 10 | 36 | |
| 32 | 11 | 40 | 23 | 30 | 11 | | |
| 31 | 19 | 41 | 9 | 25 | 6 | 42 | |
| 32 | 25 | 43 | | 26 | 5 | | |
| 34 | 5 | 47 | 20 | 25 | 8 | 49 | |
| 33 | 45 | 49 | 24 | 31 | 10 | 45 | |
| 35 | 1 | 54 | 10 | 30 | 8 | 33 | |
| 34 | | 54 | 4 | 41 | 5 | 54 | |
| 33 | 41 | 54 | | 22 | 5 | 12 | |
| 33 | 51 | 55 | | 23 | 6 | 35 | |
| 34 | 59 | 60 | | 36 | 7 | 2 | |
| 36 | 32 | 59 | 30 | 23 | 7 | 49 | |
| 37 | 1 | 61 | 10 | 33 | 6 | 45 | |
| 37 | 5 | 66 | 22 | 44 | 5 | 25 | |
| 36 | 53 | 66 | 40 | 30 | 4 | 45 | |
| 36 | 36 | | | 30 | 5 | | In the *Soundings*, 20 Leagues off Cape *Henry*. |

## *Return.*

| Latitude. North. | | Longitude. Weſt. | | Sun's Altitude. | Variation. Weſt. | |
|---|---|---|---|---|---|---|
| ° | ' | ° | ' | | ° | ' |
| 38 | 9 | 57 | 40 | 24 | 11 | |
| 38 | 48 | 55 | 50 | 25 | 10 | |
| 42 | 13 | 43 | 48 | 29 | 14 | |
| 44 | 21 | 33 | 17 | 19 | 14 | 26 |
| 45 | 46 | 28 | 17 | 23 | 15 | 45 |
| 49 | 51 | Off *Plymouth.* | | | 13 | 27 |
| 50 | 20 | Off *Portland.* | | | 13 | |

## *The Third Voyage* 1734.

| Latitude. North. | | Longitude. Weſt. | | Sun's Altitude. | Variation. Weſt. | |
|---|---|---|---|---|---|---|
| ° | ' | ° | ' | | ° | ' |
| 39 | 53 | 6 | 37 | 28 | 14 | 30 |
| 37 | 50 | 6 | 40 | 21 | 14 | |
| 36 | 58 | 10 | 30 | 26 | 15 | |
| 34 | 56 | 13 | | 30 | 13 | 40 |
| 33 | 33 | 16 | 10 | 27 | 12 | 10 |
| 33 | 9 | 17 | 38 | 27 | 9 | 13 |
| 32 | 44 | 18 | 6 | 24 | 9 | 51 |
| 31 | 39 | 20 | 13 | 34 | 9 | 49 |
| 30 | 55 | 22 | 53 | 25 | 9 | 6 |
| 30 | 17 | 25 | 26 | 36 | 8 | 39 |
| 30 | 1 | 27 | 14 | 28 | 7 | 56 |
| 30 | 1 | 27 | 54 | 27 | 6 | 48 |
| 29 | 55 | 30 | 20 | 24 | 7 | 41 |
| 29 | 57 | 33 | 12 | 32 | 8 | |
| 29 | 51 | 37 | 37 | 32 | 5 | 41 |

| Latitude. North. | | Longitude. Weſt. | | Sun's Alti-tude. | Variation. Weſt. | |
|---|---|---|---|---|---|---|
| ° | ' | ° | ' | | ° | ' |
| 28 | 55 | 39 | 28 | 27 | 5 | 23 |
| 29 | 8 | 40 | | 26 | 7 | 12 |
| 31 | 10 | 44 | 46 | 30 | 8 | 6 |
| 31 | 7 | 46 | 45 | 22 | 4 | 46 |
| 30 | 42 | 49 | | 38 | 4 | 40 |
| 30 | 29 | 49 | 48 | 22 | 4 | |
| 30 | 31 | 52 | 10 | 25. | 4 | 49 |
| 30 | 18 | 53 | | 25 | 4 | 45 |
| 30 | 23 | 55 | | 25 | 4 | 22 |
| 30 | 58 | 57 | 30 | 22 | 4 | 52 |
| 37 | 9 | 68 | | 38 | 4 | 50 |

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## VI. *Some* Thoughts *and* Conjectures *concerning the* Cauſe *of* Elaſticity, *by* J. T. Deſaguliers, *LL. D.* F. R. S.

ATtraction and Repulſion ſeem to be ſettled by the Great CREATOR as firſt Principles in Nature; that is, as the firſt of ſecond Cauſes; ſo that we are not ſolicitous about their Cauſes, and think it enough to deduce other Things from them. If Elaſticity was admitted as a firſt Cauſe, (as it is by ſome) it is thought we ſhould admit of too many principal Cauſes in Nature, which is contrary to the Rules of good Philoſophy. Philoſophers therefore have endeavour'd to deduce Elaſticity from Attraction, or from Repulſion, or from both. It is obſerv'd, that the ſame Particles that repel each other ſtrongly, will attract other Particles very ſtrongly; as appears by many Chemical Diſſolutions, eſpecially by the alternate Diſſolution and Precipitation of Metals in acid *Menſtruums*. The Reverend and Learned Dr. *Hales* has proved this many Ways, in his *Vegetable Statics* and *Hæmaſtatics*. The Elaſticity of Air ſeems to conſiſt wholly in the repulſive Power of its Particles, which do not touch one another while the Air is in its elaſtic State; and if thoſe Particles be brought nearer and nearer together, the Effect of their repulſive Force will increaſe, the Air's Elaſticity being always proportionable to its Denſity by Compreſſion, which Property will be preſerv'd, though compreſs'd Air be kept a Year or two; notwithſtanding Mr. *Hauksbee* in his *Phyſico-mechanical Experiments* ſays, that Air will loſe part of its Spring by being very much compreſs'd. But the Air with which he try'd it, muſt have been fill'd with moiſt Vapours; and it is well known, that the Steam of Liquors will loſe its Elaſticity, eſpecially where its Heat decays. I have kept ſeveral Wind-Guns, ſtrongly charg'd, for half a Year together, in which the Air had loſt none of its Elaſticity: Others have found the Air as ſtrong after a Year; and I have been told by a Perſon of Credit, that a Wind Gun having been laid by and forgotten for ſeven Years, when it was found, diſcharg'd its Air as many times, and with as much Force, as it uſed to do. Now, though Air, compreſs'd by any external Force, does always increaſe in Elaſticity, as it diminiſhes in Bulk; yet it may, by Fermentation, diminiſh its Bulk very much, without gaining any more Elaſticity: For if another Fluid, whoſe Parts repel one another, but attract the Parts of Air, be mix'd with Air, the Repulſion of any two Particles of Air will be diminiſh'd, in proportion as a Particle of the other Fluid, inſinuating itſelf between them, attracts them towards itſelf on either Side. The ſame thing will happen to the other Fluid, in reſpect of the Particles of Air, which mixing with its Particles, do in the ſame manner deſtroy their Repulſion. Thus, if we allow an Attraction ſtrong enough between the Parts of two elaſtic Fluids, it is poſſible, that by Fermentation a Solid may be made out of two elaſtic Fluids, which would have ſtill continued fluid without ſuch a Mixture. We are taught by Chemiſtry, to mix Fluids together, which immediately coaleſce into a Solid. When Brimſtone Matches are burning, the *Effluvia* of the Sulphur repel each other to great Diſtances, as may be known by the ſulphureous Smell upon ſuch an Occaſion. Now, though theſe Particles repel each other, they attract the Air very ſtrongly, as appears by the following Experiment:

Take a tall Glaſs Receiver cloſ'd at Top, holding about four Quarts of Air, and having put its open End over a Bundle of Brimſtone Matches on Fire, ſtanding up in the Middle of a large Diſh with Water in it, (to keep the Air from coming in at the Bottom of the ſaid Receiver) you will obſerve, that not only as ſoon as the Matches are burnt out, but a good while before, the Air, inſtead of being expanded by the Flame of the Brimſtone, will retire into leſs Compaſs, the Water beginning to riſe from the Diſh up into the Receiver, and continuing ſo to do till ſome time after the Matches are burnt out; ſo that there will be in the Receiver only three Quarts of Air, inſtead of four (more or leſs, in pro-

portion

portion to the Quantity of Brimſtone burnt): And this plainly happens by ſome of the *Effluvia*, or little Parts of the Sulphur, attracting ſome of the Particles of the Air, ſo as to make an unelaſtic Compound, that precipitates into the Water. If the Elaſticity of the Air is quite loſt when the Repulſion of its Particles is taken off, or ſufficiently counteracted, it muſt follow, that its Elaſticity depends upon Repulſion: And that this is often the Caſe, appears by a great Number of Dr. *Hales*'s Experiments, of which I will mention but a few. The Doctor took a Cubic Inch of Mutton-Bone, and having put it into his Gun-Barrel Retort, he diſtill'd out of it two or three hundred Cubic Inches of Air into a large glaſs Bottle, the Weight of which Air, together with the Aſhes of the Bone left, weighed as much as the whole Quantity of Bone did at firſt. Now the Air had been confin'd in that Bone, together with many ſulphureous Particles, in ſuch manner, that the mutual Attraction of the Sulphur and the Air had alternately deſtroy'd each other's repulſive Force, and brought thoſe Subſtances into a little Compaſs; but the Fire in the Diſtillation ſeparated them from each other, ſo as to reſtore them, in a great meaſure, to their uſual Elaſticity. This appear'd by bringing a Candle near the Mouth of the Bottle that held this reviv'd Air; for every time the Candle was brought near, the Air took Fire, and flaſh'd out of the Bottle with a ſulphureous Smell. The Air may be conſolidated in many hard Bodies, ſo as to be there quite void of Elaſticity, and there do the Office of a Cement, till by the Action of Fire, or ſome particular Fermentations, it is again reſtor'd to its perfectly elaſtic State.

This is the Meaning of the Doctor's Words, when he ſays, that ſome Bodies *abſorb*, and others *generate* Air; and the ſame Bodies do ſometimes abſorb, and at other times generate Air. He found more or leſs Air in almoſt every ſolid Subſtance that he try'd; but, what was moſt remarkable, he found that the *Calculus humanus* (or Stone taken out of a Man's Bladder) was made up of above half its Weight of Air.

Some have endeavour'd to ſolve Elaſticity by Attraction only; as for Example: If the String *AB* (Tab. I. Fig. 1.) be conſider'd as made up of Particles lying over one another in the manner repreſented at *ALB*; it is plain, that if the Point *D* be forcibly brought to *C*, the Parts will be pull'd from each other; and when the Force, that ſtretch'd the String, ceaſes to act, the Attraction of Coheſion (which was hinder'd before) will take place, and bring back the String to its former Length and Situation after ſeveral Vibrations. Now, though this ſeems to agree pretty well with the *Phænomena* of a String in Motion, it will by no means ſolve the Elaſticity of a Spring faſten'd at one End, and bent either way at the other, like a Knife or Sword-blade, as in Fig. 2. For if ſuch a Spring be bent from *A* to *a*, the Particles on the Side *C*, which now becomes convex, will be farther aſunder at *F*, while the Particles at *D*, carried to the concave Part *E*, will come cloſer together: So that the Attraction, inſtead of making the Spring reſtore itſelf, will keep it in the Situation in which it is, as it happens in Bodies that have no Elaſticity, where perhaps only Attraction obtains. Thus a Plate of Lead, a Plate of Copper, and a Plate of ſoft Iron, ſtands bent.

But the moſt probable way of ſolving the Elaſticity Springs, is to conſider both a repulſive and attractive Property in the Particles, after the manner f the black Sand, which is attracted by the Loadone, and has been ſhewn by the learned and ingeious Profeſſor *Petrus van Muſchenbrook*, to be noing elſe but a great Number of little Loadſtones.

Fig. 3. Let us ſuppoſe a Row of round Particles ouching one another only in the Points *c* in a Line from *A* to *B*. It is plain, from what Philoſophers have ſhewn, concerning the Attraction of Coheſion, that upon the leaſt Shake, or Alteration of the Poſition of a ſtrait Line, theſe Particles will run together, and form a Sphere, in which the Globules will have more Points of Contact. But if theſe Particles have Poles like Magnets in the oppoſite Places mark'd *n*, *s*, ſo that all the Poles *n*, *n*, *n*, &c. repel one another; and all the Poles *s*, *s*, *s*, &c. do likewiſe repel one another, the Line *AB* will continue ſtrait; for if by any Force the ſaid Line *BA* be put into another Poſition, as into the Curve *ba*, then the Poles *nn*, &c. being brought nearer together, (while the Poles *s*, *s*, &c. are farther aſunder) will repel one another more ſtrongly, and thereby hinder the Globules from running together towards the concave Part; and the Spring, left to itſelf, (all this while ſuppoſing one End, as *b*, *B*, or $\beta$, fix'd) will reſtore itſelf, throwing its End *a* back to *A*, and ſo on to $\alpha$, by the firſt Law: Then being in the Poſition $\alpha\beta$, the Poles *s*, *s*, &c. are brought nearer together, whoſe Repulſion, thus increas'd, throws back $\alpha$ to *A*, and ſo on forward, the Line of Particles performing ſeveral Vibrations round *B*.

May not a Spring of Steel, or other Springs, conſiſt of ſeveral Series of ſuch Particles, whoſe Polarity and Attraction acting at the ſame time, will ſhew why ſuch Bodies, when they have been bent, vibrate, and reſtore themſelves?

If we take a Plate of Steel, and make it ſo hot till it looks white, and then immediately quench it, we thereby fix the Metal in a State very near Fluidity, ſo that the Particles which the Fire had almoſt brought to Roundneſs, have but a very ſmall Contact; as appears by the Fragility of the Steel thus harden'd, which breaks like Glaſs, and has a ſhort Grain. Steel, thus harden'd, is highly elaſtic; for what Workmen call *hard*, is the moſt *elaſtic*: as appears by the Congreſs of high-harden'd Steel Balls, which return, in their Rebound, the neareſt to the Place we let them fall from; and, next to Glaſs, have the quickeſt Elaſticity of any thing we know.

That we may not be thought to have given an imperfect Account of the Elaſticity of a Steel Spring, becauſe ſuch an one as we have deſcrib'd wants Toughneſs, and will immediately fly when bent to any Degree; we muſt beg Leave to conſider farther the Properties of the round Particles, or little Spheres, of Steel, in which we have ſuppos'd a Polarity.

Let us ſuppoſe *AB* (Fig. 4.) to be two little Spheres or component Particles of Steel, in which, at firſt, we will ſuppoſe no Polarity, but only an Attraction of Coheſion. Then, whether the Particles have their Contact at *c*, *d*, *e*, *n*, or at δ, ε, *s*, their Coheſion will be the ſame; and the leaſt Force imaginable will change their Contact from one of thoſe Points to another; becauſe in the rolling of theſe little Spheres, they do not come into more or leſs Contact in one Situation than another. But if we ſuppoſe the Point *n* in each Spherule to be a Pole with a Force to repel all the other Points *n* in any other Spherule, and likewiſe *s* another Pole, repelling the other Points *s*; the Spherules will cohere beſt, and be at Reſt in that Poſition where the Points *c*, *c*, are in Contact, and *n* and *s* at equal Diſtances on either Side. For if the Spherules be turn'd a little, ſo as to bring the Points *d*, *d*, into Contact, as in Fig. 5. the Poles *n*, *n*, being brought nearer, act againſt each other with more Force than the Points *s*, *s*, which are now farther off, and conſequently drive back the Spherules to the Contact at *c*, *c*, beyond which continuing their Motion, they will go to *δ δ*, Fig. 6. and ſo backwards and forwards, till at laſt they reſt at *c*, *c*, which we may call *the Point of Æquilibrium for Reſt* in a Spring. Now there are, beſides this, two other *Points of Æquilibrium*, beyond which the Spring may break, which are the Points *e*, *e* towards *n*, and *ε*, *ε* towards *s*; ſee Fig. 7. that is, when the Spherules have their Poles *n*, *n* brought very near together, the mutual Repulſion increaſes ſo, that the Attraction at the Contact is not able to hold them, and then they muſt fly aſunder, the Spring breaking. We ſuppoſe the Points *e*, *e*, to be the Points of Contact, beyond which this muſt happen; but that if the Contact be ever ſo little ſhort of it, as between *e* and *d*, the Spherules will return to their Contact at *c*, after ſome Vibrations beyond it, as has been already ſaid. This is the Reaſon why I call *e*, (in one of the Spherules) and its correſpondent Point *ε* on the other Side *ε*, *the Points of Æquilibrium*; for if the Spring be beat bent towards *a* (Fig. 3.) ſo that the Spherules, like *A* and *B*, (Fig. 7.) touch beyond *e*, the Spring will break: Likewiſe if the Spring be bent the other way, till the Spherules touch beyond ε, then it will break the other way. Now when the Spherules touch at *e*, *e*, or at ε, ε, the Spring is as likely to return to its firſt Poſition as to break; for which Reaſon I have call'd the Points *e* and ε, *Points of Equilibrium*, as alſo having known by Experience, that a Spring left bent to a certain Degree, has, after ſome time, broke of itſelf.

From all this it appears, that Spherical Particles will never make a tough Spring; therefore the Figure of the Particles muſt be alter'd, in order to render it uſeful; and this is what is done in bringing down the Temper of the hard Steel, and *letting down a Spring*, as it is call'd. What Change ought to be made in the Particles, we ſhall firſt ſhew; and then conſider how far that is done by thoſe who make Springs.

If the Parts ſuppos'd Globules, as in Fig. 3. are now flatten'd at *c*, where the Contact is, ſo as to put on the Shape *n e d c* δ ε *s*, (as in Fig. 8.) the Contact will be much increas'd, and reach from *d* to δ, ſo that in bending the Spring there will ſtill remain a great Contact in the Particles, and the Points of *Æquilibrium* for breaking (*viz*. *e*, *e* above, and ε, ε below) will be remov'd nearer to the Poles *n*, or *s*, than when the Particles are round; the Conſequence of which will be, that the Spring muſt be bent much farther, to be in Danger of breaking, than in the former Suppoſition; as may be ſeen in Fig. 9. where two Particles being open'd about the Point *d* as a

Centre, the attracting Points *c*, *c*, and *δ δ*, have ſtill ſome Force to help to bring back the Particles to their whole Contact; becauſe in this Shape of the Particle the attracting Points *c*, *c*, *δ*, *δ* are remov'd but in Proportion to their Diſtance from the angular Point *d*; whereas if the Particles had been ſpherical, and the Line *d δ* an Arc of a Circle, the attracting Points *c*, *c*, and *δ*, *δ*, would have remov'd from one another farther than in Proportion to twice the Square of the Diſtance from *d*, (as in Fig. 5.) and ſo have afforded very little Help for bringing back the Particles to their Contact. A Row of Particles in the Spring thus condition'd, is to be ſeen in the natural State at *B A*, Fig. 10. and bent at *b a* in the ſame Figure. Here it is to be obſerv'd, that if in this Figure of the Particles you would bend the Spring to bring the Particles to touch at their Point of *breaking Æquilibrium*, you muſt open them ſo much on the contrary Side, that the Spring will be bent far beyond any Uſes intended to be made of it, as appears by Fig. 11. where two Particles are brought to touch at the equilibrating Point *e*; and by Fig. 12. where many Particles being put into that Condition, the Spring is brought round quite into a Circle.

Now the common Practice in making Springs is the moſt likely to produce this Effect requir'd in the Particles; for the hard Spring, whoſe Particles were round, or nearly ſo, is heated anew, and whilſt it is cooling gently, the mutual Attraction increaſes the Contact, ſo that the Particles grow flatter in thoſe Places where before they had but a ſmall Contact; and leſt this Contact ſhould become too great, the Spring's Softening is ſtopp'd by quenching it in Water, or Oil, or Greaſe. Another way of making Springs, is to begin and ſhape them in cold unelaſtic Steel, and then having heated them to a ſmall Degree, for Example, to a Blood red Heat, immediately to cool them in ſome proper Liquors. This alſo ſettles the Particles in their oblong Figure, through which they muſt paſs before they become round, or nearly ſo, in a white Heat. That Particles of Steel are fix'd in the Figures which they have at the Inſtant of dipping, will not appear ſtrange, when we conſider, that dipping red-hot Steel in cold Liquors, in a particular Poſition, makes it magnetical. If it be ask'd, How we account for making Springs only with hammering, it is eaſily anſwer'd, That we can make Iron and Steel magnetical only with hammering; and if we can give and deſtroy Poles in the whole Piece, there is no Improbability to think we can give Poles to little Parts; or rather bring into a particular Situation the Poles which they have; for if the Poles that we have conſider'd be plac'd quite irregularly, there will be no Elaſticity at all. Agreeable to this, Springs may be made of other Metals than Iron or Steel, though not ſo perfect, by Hammering; for it will be ſufficient for the little Particles to have Poles that attract and repel one another, driven by the Hammering into a regular Order.

N. B. *This, apply'd to the Vibration of a String, will better ſolve its ſeveral Caſes than Attraction alone*; and the Elaſticity of Glaſs is juſt the ſame as that of a very brittle *Steel-Spring*.

# VII. *Some* Thoughts *and* Experiments *concerning* Electricity, *by* J. T. Deſaguliers, *LL. D.* F. R. S.

THE *Phænomena* of Electricity are ſo odd, that though we have a great many Experiments upon that Subject; we have not yet been able from their Compariſon to ſettle ſuch a Theory as to lead us to the Cauſe of that Property of Bodies, or even to judge of all its Effects, or find out what uſeful Influence Electricity has in Nature: Though certainly, from what we have ſeen of it, we may conjecture, that it muſt be of great Uſe, becauſe it is ſo extenſive.

Though ſome Perſons have been too haſty in their Conjectures, and too apt to run into Hypotheſes not ſufficiently ſupported by Experiments; yet it would be of great Uſe to ſettle ſome general Propoſitions concerning Electricity from the Light we have already, and what we may further diſcover by future Experiments; provided we have a ſufficient Number of them to ſettle a general Rule. For Example; I now propoſe ſome general Aſſertions to be conſider'd, and to be rejected or allowed of as a Number of Experiments ſhall determine; but to ſtand only as *Queries* till they are ſettled.

I have hitherto avoided entertaining the SOCIETY upon this Subject, or purſuing it ſo far as I might have done, (conſidering that I can excite as ſtrong an Electricity in Glaſs, by rubbing it with my Hand, as any body can) becauſe I was unwilling to interfere with the late Mr. *Stephen Gray*, who had wholly turn'd his Thoughts that way; but was of a Temper to give it intirely over, if he imagin'd, that any thing was done in Oppoſition to him. But now I intend not only to go on myſelf in making electrical Experiments, but ſhall always be ready to make ſuch as ſhall be propoſed by any Member of the SOCIETY. The *Queries* which I have already examin'd, are the following:

*Query* I. Whether all Bodies in general are not capable of receiving the Electricity which has been given to a Tube by Friction, though there be a great many Bodies, ſuch as Metals and Vegetables, *&c.* in which we have not hitherto been able to excite any Electricity by Heat, or Friction, or any other Operation on the Bodies themſelves?

*Query* II. Whether when a String is ſtretch'd out at Length, with a Body hanging at one End of it, to which Body we would communicate the Electricity of the Tube rubb'd at the other End, the Supporters of the String ought not to be of ſuch Bodies as are capable of having Electricity excited in them by Friction, Heating, Beating, or Patting, or ſome immediate Operation on the Bodies themſelves?

*Query* III. Whether theſe Supporters of the String (mention'd in the laſt *Query*) which ſtops the electrical Virtue from paſſing any farther, are not of ſuch a kind as are incapable of having the electrical Virtue excited in them immediately by any Operation yet known; though they are all capable of receiving it from a rubb'd Tube, even at a great Diſtance, by the Communication of a String made of vegetable Subſtances?

*Query* IV. Whether the Reaſon that ſome Supporters tranſmit the Electricity running from the rubb'd Tube along the String to Bodies beyond them, be not as follows, *viz.* That having receiv'd ſome of the electrical Stream, they ſoon become ſaturated with it, and ſo receiving no more of it, let the reſt paſs on without diſturbing it?

*Query* V. Whether the Reaſon, that Supporters made of vegetable Subſtances, Metals, and ſuch others, as ſtop the Electricity above-mention'd from running any farther along the String than the Place where it reſts upon them, be not this? *viz.* That they are never ſaturated with the electrical Stream, but continually receive it, and tranſmit it to the next contiguous Body, provided that contiguous Body be of the ſame kind with themſelves, and alſo contiguous to other Bodies of the ſame ſort: I mean ſuch as would ſtop the Electricity, if the String was ſupported by them. For even theſe Supporters will tranſmit the Electricity, if terminated at each End by Bodies that tranſmit the Electricity, when they ſupport the String.

*Query* VI. Whether we may not diſtinguiſh all Bodies in general, in reſpect of Electricity, into ſuch as may be excited to Electricity, and ſuch as cannot be excited to Electricity? the two kind of Bodies receiving the Electricity from other Bodies into which it has been excited differently; the firſt alſo tranſmitting the Electricity, while the others do not.

Theſe *Queries* are ſuch as ariſe from a Conſideration of Experiments made by others, and ſuch as I have made myſelf.

As I go on in making other Experiments, other *Queries* may ariſe, and I ſhall communicate them.

Here follow the Experiments I have already made, and am ready to repeat as the SOCIETY may deſire.

### EXPERIMENTS *relating to the Firſt Query.*

I ſtretch'd a Cat-gut about five Feet in Length, and faſten'd it to the Top of two Chairs in an horizontal Situation, and ſuch another Cat-gut String to two other Chairs parallel to the firſt, and at the Diſtance of 15 or 20 Feet from the former. Then I ſuſpended one End of a Packthread to the Middle of the firſt Cat-gut, and carried it on ſo as to lay it over the Middle of the other Cat-gut, and leave the other End of the Packthread hanging down about a Foot below the Cat-gut, with a Loop to hang ſeveral Bodies to it, ſucceſſively to receive the Electricity excited by the Tube, and applied to the other End of the Packthread.

All the Bodies I tried received the Electricity communicated from the rubb'd Tube along the String, which appear'd by holding a Thread faſten'd to a Stick, the Thread being attracted towards the ſuſpended Body.

1. A Gold Medal. 2. A Silver Medal. 3. A Copper Medal. 4. A Braſs Ball. 5. A Steel Ball. 6. A Tin Ball. 7. A Leaden Ball. 8. Sulphur. 9. Sealing-Wax. 10. Pumice-Stone. 11. Bees-Wax. 12. Reſin. 13. *Sal Armoniac.* 14. Ivory. 15. Human Bone. 16. Fiſh-Skin. 17. Loadſtone. 18. Fleſh. 19. Cotton. 20. Wax-Candle. 21. Tallow-Candle. 22. A Leak. 23. Celeri. 24. Tobacco-

bacco-Pipe. 25. A Glaſs-Ball. 26. A Ruſh rolled up.

### EXPERIMENTS *relating to Query* II.

Retaining the firſt ſupporting String of Cat-gut, inſtead of the laſt Cat-gut Supporter, I made the Packthread paſs over the following Subſtances ſucceſſively, all which tranſmitted the Electricity to the Body ſuſpended at the End of the Packthread; *viz.* 1. A Silk String. 2. Hair Rope. 3. Parchment. 4. A Thong of Sheep-skin, but it ſtopp'd the Electricity till it was dry and warm. 5. A Liſt of Woollen Cloth. 6. A Liſt of Flanel. 7. Cadis, or a kind of Worſted Tape. 8. Quills. 9. Whalebone. 10. A Man's Thigh-Bone. 11. A Bladder. 12. A Cat, held between two. 13. A Tallow-Candle. 14. A Wax-Candle (the String was alſo laid over the unburn'd Cotton Wick at the End of the Candle). 15. A Tallow-Candle and its Wick. 16. Tobacco-Pipe, with a Cat-gut or a Packthread through it, or without, that is, a Packthread String being faſten'd at each End of it. 17. A Sword-Belt. 18. A Piece of a white Hat. 19. A Piece of a black Hat. 20. A Glaſs Tube. 21. The ſame with Water in it. 22. With Spirit of Wine. 23. The ſame with Mercury in it. 24. Sealing-Wax. 25. Crape.

*N. B.* All theſe Subſtances, except the Sheep-skin, the Tobacco-Pipe, the Quills, the Candles, and the Bone, not only tranſmitted the Electricity, but became ſo far electrical, as to attract the Thread a little way on each Side of the ſupported Packthread.

There are more Experiments requir'd to be made, before this *Query* can be turn'd into an Aſſertion.

## EXPERIMENTS *relating to Query* III.

Inſtead of the laſt Supporter of Cat-gut near the ſuſpended Body, I made uſe of the following Subſtances ſtretch'd from Chair to Chair; and then the Thread hanging on the Stick was not at all attracted by the ſuſpended Ivory Ball, which I made uſe of in all the Experiments to try the Supporters.

1. A Hempen Rope. 2. A ſmall Packthread. 3. A drawn Sword. 4. A Sword in the Scabbard. 5. The Scabbard without the Sword. 6. A twiſted Cotton Thread. 7. Tape made of Thread. 8. Bars, Tubes and Wires of Copper, Braſs, Iron and Lead. 9. White Paper and brown. 10. A moiſt Thong of Sheep-Skin. 11. Celeri. 12. Leeks. 13. Fir-wood. 14. A Cane. 15. A Piece of black Thorn. 16. The ſame Ruſhes that had before receiv'd the Electricity when ſuſpended. 17. A Spunge dry. 18. White Thread. 19. Hay. 20. A Marble Slab.

*N. B.* Such Bodies as were too ſhort to reach from Chair to Chair, were lengthen'd out by Pieces of Packthread at each End.

## EXPERIMENTS *relating to Query* IV.

The Cat-gut Supporters, and all the others mention'd in the Experiments to *Query* III. which tranſmitted the Electricity, attracted the Thread of the Stick near the conducting Packthread, but not ſo far as the Chairs to which the ſaid Supporters were faſten'd.

## EXPERIMENTS *relating to Query* V.

All the Supporters which did not tranſmit the Electricity, when they reach'd from Chair to Chair, were made to tranſmit, when they were lengthen'd out with Cat-gut at each End, and then they became electrical themſelves from one End to the other, as becoming part of the ſuſpended Body; and becoming ſo ſaturated, as not to be able to carry the Electricity on either Side any farther than the Cat-gut to which they were faſten'd.

## EXPERIMENTS *relating to Query* VI.

The late Mr. *Stephen Gray* has, by rubbing, excited Electricity in ſeveral of thoſe Bodies which I have made Supporters of to tranſmit the Electricity (See *Philoſoph. Tranſ.* N° 366.): I have done the ſame with ſeveral others, but not with all of them, though I ſhall try them all: But as it is more difficult to excite that Virtue in ſome than others; and all the Experiments in general ſucceed better in dry and cold Weather than in moiſt and warm, I muſt wait for proper Opportunities to make the Experiments, and then I ſhall communicate them.

## EXPERIMENTS *concerning mix'd Subſtances.*

1. Cadis (or Woollen Tape) laid on Thread-Tape, when made a Supporter, tranſmitted the Electricity.

2. When the Thread-Tape was uppermoſt, the Electricity was ſtopp'd.

3. When they were twiſted together, the Electricity was tranſmitted, but moſt weakly when the Pack-

thread going to the Ball was laid over that Part of the Twiſt which had the Thread-Tape.

*N. B.* The two Paper Supporters which did not tranſmit the Electricity, ought to have done it according to *Query* II. becauſe, by Mr. *Gray*'s Experiments, Electricity is to be excited in the Paper by rubbing: Therefore, perhaps, the Papers wanted to be drier or warmer, ſo that I ſhall try them again. Theſe are the only two Experiments that do not agree with the ſecond *Query*; but I would not omit mentioning them, becauſe it is the Part of an impartial Philoſopher to mention as well thoſe things which favour, as thoſe that diſagree with his Hypotheſes and Conjectures.

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## VIII. EXPERIMENTS *made before the* ROYAL SOCIETY, Feb. 2. 1737-8. *by* J. T. Deſaguliers, *LL.D.* F. R. S.

*N. B.* IN the following Account, which is the Sequel of former Experiments, I call *Conductors* thoſe Strings, to one End of which the rubb'd Tube is applied; and *Supporters* ſuch horizontal Bodies as the *Conductor* reſts upon.

### EXPERIMENT I.

Old Packthread Supporters tranſmitted Electricity but weakly, though more ſtrongly when twiſted with Cat-gut; but new Packthread did better.

N. B. *Where it is not mention'd otherwiſe, an Ivory Ball hangs at the End of the* Conductor;

*and its Electricity is tried by a Thread applied near it.*

### EXPERIMENT II.

A Conducting String of Cat-gut receiv'd the Electricity a little way; but did not carry it quite to the Tube.

### EXPERIMENT III.

Two conducting Strings, one of Cat-gut, and one of Packthread, compar'd, the firſt attracted leſs and leſs, as the Diſtance from the Tube increas'd; and the other more and more, till it was ſtrongeſt at the ſuſpended Body: But both ceas'd immediately after the Removal of the Tube.

### EXPERIMENT IV.

A Sealing-Wax Supporter tranſmitted the Electricity, but did receive little or none when ſuſpended. If it was but juſt rubb'd with the Hand, it attracted the Thread when firſt ſuſpended; and ſtrongly, if much rubb'd; but that Virtue was ſoon loſt, if the Tube was apply'd to the conducting String, and then it would receive no more Electricity from the Tube. If the Stick of Wax was wet, then it would ſtrongly receive the Electricity.

A Wax Supporter wet, and Silk String wet, did not tranſmit the Electricity.

### EXPERIMENT V.

Dried Ox-Guts did not tranſmit Electricity when held in Hand; but when tied to Cat-gut, tranſmitted it; and, when ſuſpended, received it plentifully.

## EXPERIMENT VI.

The ſame with a ſmall Cord.

## EXPERIMENT VII.

The ſame with a Rod of Iron, and Tube of Braſs.

## EXPERIMENT VIII.

A Glaſs Tube, made Conductor, receiv'd the Electricity but a little way.

## EXPERIMENT IX.

Dry Sheep-Skin tranſmitted the Electricity, but not when wet, though it receiv'd it then when ſuſpended.

## EXPERIMENT X.

A middle Supporter of Packthread was again ſupported on one Side by a Glaſs Tube, and on the other by Sealing-Wax, and had at each End an Ivory Ball hanging. Thoſe Balls became electrical in the ſame manner, and at the ſame time, as the Ball at the End of the conducting Spring.

## EXPERIMENT XI.

When a Bar of Oak was made uſe of inſtead of the Tube, or a ſmall Iron Bar inſtead of the Wax, the Electricity was ſtopp'd: But if the Bar was thruſt a little way into a Glaſs Tube, the Electricity was communicated as before.

# EXPERIMENTS *made at the* ROYAL SOCIETY, Feb. 9. 1737-8.

I fixed ſix Iron *Radii* of twiſted Iron Wire to a Braſs Ring of two Foot and an half Diameter, and half an Inch wide, which had a Socket in the Centre, whereby to ſet it either on an upright Glaſs Tube, or on a wooden Pillar: Then I hung upon the End of the ſix *Radii*, next to the Circumference, the following Subſtances. 1. A Piece of Reſin. 2. A Stick of Wax. 3. An Apple. 4. An Ivory Ball. 5. A Steel Ball. 6. A Glaſs Ball.

## EXPERIMENTS I. and II.

I rubb'd the Tube, and applied it to the Centre of this Machine, as it ſtood on a Glaſs Tube; and the Electricity was communicated to all the ſuſpended Bodies, and the Ring alſo; but none of them receiv'd it, when the Machine ſtood upon a wooden Pillar, whoſe Foot was on the Floor.

## EXPERIMENT III.

I tied to the Ends of the ſix *Radii* as many Cat-gut Strings, but ſo long as to unite together about a Foot higher than the Centre of the Ring, where I ſuſpended them by another Cat-gut String three Foot long, the Top of which was faſten'd to an hempen Rope. Then applying the rubb'd Tube very near the Place where all the Cat-gut Strings join'd over the Ring, (at which Ring the ſame Bodies were ſuſpended as before) neither the Bodies nor Ring receiv'd any Electricity.

*N. B.* This was done in foul Weather, when the Electricity does not extend itſelf far from the Tube: But in fair Weather, the Electrical Virtue, at the ſame Diſtance, reach'd the Iron *Radii* of the Ring; and conſequently the Ring and Bodies ſuſpended, though the Virtue was not propagated along the Cat-gut: For if the Tube was applied a little higher to the ſingle Cat-gut, ſo as the *Effluvia*, or Virtue darted directly from the Tube, did not reach the Ring, or its Iron *Radii*, then no Virtue was communicated to the Ring, or the ſuſpended Bodies, *&c.*

## EXPERIMENT IV.

I ſuſpended the Ring by ſix Packthreads, juſt in the ſame manner as the Cat-gut Strings before; but ſtill all thoſe Strings were ſuſpended by the perpendicular Cat-gut of three Foot in Length. Then all the Bodies receiv'd the Electricity from the rubb'd Tube applied to the Top of the Pyramid of Packthreads.

## EXPERIMENT V.

Inſtead of the perpendicular Cat-gut between the Pyramid of Packthread and the upper hempen String, I ſubſtituted a Packthread; and then no Virtue was communicated to the Ring, but all went up the hempen String, and was loſt; except the Tube was held very near the Ring, and then it gave a ſmall Degree of electrical Attraction to the Ring, and the Bodies ſuſpended at it.

### EXPERIMENT VI.

Having again ſuſpended the Ring with the Bodies and Pyramid of Packthreads to the perpendicular Cat-gut, I tied a Packthread to the Ring, and carried it horizontally about 20 Feet from the Ring; and having faſten'd a Cat-gut String three Foot long to it, I gave it an Aſſiſtant to hold: Then applying the rubb'd Tube to the End joining that Cat-gut, the Electricity was communicated to the Ring, and all the ſuſpended Bodies, as appear'd by applying the white Thread near them, which was attracted by every Part of the Ring, and all the Bodies.

## EXPERIMENTS *made before the* ROYAL SOCIETY, Feb. 16. 1737-8.

### EXPERIMENT I.

I applied the rubb'd Tube to a burning Candle, and it had no manner of Effect on the Flame; but as ſoon as the Candle was blown out, it attracted the Smoke at four or five Inches Diſtance.

### EXPERIMENT II.

An horizontal Packthread, of about 18 Feet in Length, being terminated by the Cat-gut Strings, of three Foot long each, I hung (towards one of the Ends of the Packthread) upon it a Candleſtick with a lighted Candle in it; then applying the rubb'd Tube to the other End of the Packthread, the Candleſtick attracted the Thread, and it was alſo attracted by the

Candle, but not within two or three Inches of the Flame; but as ſoon as the Candle was blown out, the Thread was attracted by every Part of it; nay, even the Wick, when it was quite extinguiſh'd.

### EXPERIMENT III.

I ſuſpended a Wax Candle in the ſame manner, and the Experiment ſucceeded in the ſame manner; only the Electricity came not ſo near the Flame in the Wax as in the Tallow Candle.

### EXPERIMENT IV.

I hung an Iron Wire 16 Foot long horizontally by two Cat-gut Strings at its Ends about three Foot long each, and bent down the Wire from the Place join'd to the Cat-gut, ſo as to hang down a Foot at one End; then applying the rubb'd Tube at the other End, this Conductor carried the Electricity along to the Ball; but not ſo well as the Packthread Conductor; but it did ſomething better when it was wet.

The ſame happen'd when the Conductor was Braſs Wire of the ſame Length.

*N. B.* The Packthread Conductor alſo carried the *Effluvia* ſtronger when it was wet.

# X. *An Account of ſome* Electrical Experiments *made before the* ROYAL SOCIETY *on* Thurſday *the* 16*th of* February 1737-8. *By the Same.*

## EXPERIMENT I.

### TAB. I. Fig. I.

I Took the Glaſs Tube *AB* of two Inches Diameter, which had at one End *A*, a Braſs Ferril with a Brim cemented to it, and at the other End *B*, a Braſs Cap cloſe at Top, the Braſs-work being join'd to it, in order to exhauſt it of its Air upon Occaſion. When this Tube was very dry, it would become electrical by rubbing, ſo as to ſnap by paſſing the Ends of the Fingers near it; but that Virtue could not be excited in the Tube nearer the Braſs at the Ends than from *a* to *b*, and not unleſs the Tube was very dry within.

The Tube being thus prepar'd, and having an Ivory Ball *C*, of about two Inches Diameter, tied to it at the End *B* by a ſhort String, I paſſed the Tube through the horizontally ſuſpended Plate *DD*, till it was ſtopp'd by the Brim at *A*; and as it hung perpendicularly, the Ball *C* was within a Foot and an half of the Floor. The Plate *DD* was about 10 Inches in Diameter, and ſuſpended by three ſmall Cat-gut Strings as *E*, *e*, of about two Feet in Length, all which were tied together at *E*, to an hempen String hanging from the Cieling at *F*.

By reaſon of the Diſtance of the Ends of the Cat-gut Strings cloſe to the Plate at *eee*, I was able to thruſt in between them one End of an open Tube *GG*, after I had rubb'd it ſo as to make it electrical, to ſee whether I could make the aforeſaid ſuſpended Tube *AB* the Conductor of Electricity to the Ball *C*; but the firſt Trial was in vain.

## EXPERIMENT II.

Then laying horizontally over the Plate *DD* an Iron Bar a quarter of an Inch thick, and a Yard long, I hung at the Ends of it two Ivory Balls *cc*, of the ſame Size as *C*, by Packthreads of the ſame Length as the Tube *AB*.

Having again made the Tube *GG* electrical, I applied it over *A*, as before, and immediately the two Balls *cc* received the Electricity, ſo as to attract the *Thread of Trial T* hanging at the End of the Stick *ST*, when applied near them; though it received no Motion when applied to *C*. But if the Strings *Hc*, inſtead of Packthread, were Cat-gut, then the Balls *cc* received no Electricity from the Tube *GG* rubb'd and applied over *A*.

*N. B.* To be ſure that the rubb'd Tube is made electrical, I paſs my Fingers near it after rubbing, to hear whether it ſnaps; but always rub again before I apply it; becauſe by ſnapping it loſes its Electricity at the Place where it ſnaps.

## EXPERIMENT III.

When I rubb'd the Tube *AB*, it would then attract the Thread of Trial *T* between *a* and *b*; but not at above *a* or below *b*, unleſs when I applied the ube *GG* above *A*: Then the Thread of Trial ould be attracted by the Plate *DD*, and the Top the great Tube from *A* to *a*, but no lower. It ould alſo be attracted by all the Bar *HH*, and only ree or four Inches below *H*.

## EXPERIMENT IV.

Having fill'd the Tube *AB* with Water, the Elec-icity of the rubb'd Tube *GG*, applied at *A*, ran rongly down the Tube *AB*, and impregnated the all *C*, ſo as to make it ſtrongly attract the Thread of rial, whilſt the Balls *cc* received no Virtue at all. ut upon wetting the Cat-gut Strings *Hc* with a punge, all the three Balls *cC* and *c* ſtrongly receiv'd he electrical Virtue.

## EXPERIMENT V.

I took away the Bar *HH*, and its Balls and Strings; nd having well dried the Tube, I rubb'd it, and hung t up as before; ſo that it would ſnap, or attract the Thread from *a* to *b*, but no-where elſe.

Then putting the ſmall Bar *HH* into the Middle of the Tube *AB* in its Axis repreſented by the prick'd Line, upon Application of the rubb'd Tube *GG* at *A*, the Virtue was immediately communicated to the Ball *C*. The ſame thing happen'd, when, inſtead of the Bar, a Braſs Wire, a Walking-Cane, a ſmall green Stick, or ſmall Packthread, was placed in the Axis of the Tube.

### EXPERIMENT VI.

I took a Barometer Tube empty, and very dry, and placed it in the Axis of the great Tube *AB*; but it would conduct no Electricity to the Ball *C*; though it carried it down very readily when full of Water; though quite dry on the Outſide.

Another ſmall Tube open at both Ends, which conducted no Virtue to *C* when dry, being only moiſten'd a little by the Breath in blowing through it, carried down the Virtue from *A* to *C* very ſtrongly.

*N. B.* All this while the Cat-gut Strings *Ee* received no electrical Virtue.

As I deſign to purſue theſe Inquiries much further, I beg Leave to be allow'd to make uſe of ſome Terms, (which I ſhall here define) in order to ſave uſing many Words in giving an Account of ſome electrical Experiments, which I have made, and ſhall hereafter make.

### DEFINITION I.

A Body *electrical per ſe* is ſuch a Body in which one may excite Electricity by Rubbing, Patting, Hammering, Melting, Warming, or any other Action on the Body itſelf, as Amber, Sealing-Wax, Glaſs, Reſin, Sulphur, *&c.* beſides many, if not all, Animal Subſtances.

### DEFINITION II.

A *Non-electrical* is ſuch a Body as cannot be made electrical by any Action upon the Body itſelf imnmediately; though it is capable of receiving that irtue from an *Electrical per ſe*.

## OBSERVATIONS.

1. When the Air is full of moiſt Vapours, *Electri- als per ſe* are excited to Electricity with very great ifficulty, requiring to be often warm'd, and much ubb'd; as appears in exciting that Virtue in Glaſs, mber, Wax, *&c.*

2. In dry Weather, eſpecially in froſty Weather, e *Electricals per ſe* will have their Virtue excited ith very little Action upon them; as appears by arming a Glaſs Receiver, which, without any rub- ing, will cauſe the Threads of a Down Feather, tied o an upright Skewer, to extend themſelves as ſoon s it is put over the Feather. Sometimes Reſin and Vax exert their Electricity by only being expos'd to he open Air.

3. *Electricals per ſe* retain the Virtue longeſt vhen kept near to, or incloſ'd by, other *Electricals er ſe*. Thus the rubb'd Tube will retain its Virtue retty long in dry Air, as appears by chaſing a Fea- er about the Room very long without new rub- ing; as alſo by Lumps of Reſin and Sulphur, *&c.* vhich have been melted and poured into dry Drink- g-glaſſes, keeping their Virtue long, if kept in oſe Glaſſes, and wrapp'd in dry Silk, or ſuch ſort f Paper as will become electrical by rubbing; for often as they are expos'd to the Air, they will at- act.

4. *Electricals per ſe* communicate their Virtue to y of the *Non-electrical*, when brought near them; which Caſe the *Non-electricals* attract and repel

like the *Electricals per ſe*. Thus an Iron Bar ſuſpended by a ſilken Thread, an Hair Rope, or a dry Cat-gut, when an excited *Electric per ſe* is brought near it, will both attack and ſend out its *Effluvia* to a *Non-electric* held near it; as appears in the Dark by the Light coming out at the End of the Bar.

5. An *Electrical per ſe* loſes its excited Virtue in communicating to the *Non-electrical*; and the ſooner, the more of thoſe Bodies are near it. Thus in moiſt Weather the rubb'd Tube holds its Virtue but a little while, becauſe it acts upon the moiſt Vapours that float in the Air; and if the rubb'd Tube be applied to Leaf-Gold or Braſs, laid upon a Stand, it will act upon it much longer, and more ſtrongly, than if the ſame Quantity of Leaf-Gold is laid upon a Table, which has more *Non-electrical* Surface than the Stand.

6. When a *Non-electrical* is ſuſpended by, or only touches an *Electrical per ſe*, it receives the Properties of an *Electrical per ſe* from a rubb'd Tube or Wax, *&c.* This appears by the Fire that flaſhes from the Fingers of a Man ſuſpended by Hair-Ropes, or who ſtands upon a Cake of Reſin, when he has receiv'd Virtue from the rubb'd Tube.

7. The Virtue which a *Non-electrical* receives from a rubb'd Tube, runs on to the moſt diſtant Part of the ſuſpended Body from the Place where the Tube is applied, and ſeems to be collected there, from whence it flaſhes in the Dark, ſnaps, and exerts its Attraction upon the Thread of Trial; though as the Virtue runs along, it ſometimes ſhews itſelf in other Parts of the ſuſpended *Non-electrical*.

8. If a *Non-electrical*, whilſt it is receiving the Virtue from the rubb'd Tube, be made to communicate with the Floor of the Room, or any other great Non-electrical Body by a *Non-electrical* String, how ſmall ſoever, (though but a Thread) the Virtue will not ſhew itſelf, as it did before, at the Extremities, where the Flaſh of Light was ſeen.

9. If a *Non-electrical* be ever ſo big, when ſuſpended, it will receive Electricity from the rubb'd Tube. And if five or ſix hundred Foot long, when he rubb'd Tube is applied at one End, the Bodies hanging at the other End will become electrical. This has been tried by ſeveral People as well as myſelf.

10. If a long *Non-electrical* String be faſten'd to an *Electrical per ſe*, and extended to a great Diſtance, being ſupported by *Electricals per ſe* to keep it from touching the Ground, all Bodies faſten'd at the End of it will become electrical when the rubb'd Tube is applied at the other End, though the Tube does not touch it, but is only brought within two or three Inches of it.

*N. B.* This String we have before called the *Conductor of Electricity*, and the Cat-gut or ſilken ſtrings, Glaſs Tubes, or whatever kept the long String rom touching the Ground, *Supporters*.

If any of the *Supporters*, mention'd in the laſt Obervation, be chang'd for a *Non-electrical* Supporter, he Virtue will there be ſtopp'd and taken away by hat *Supporter*: But if that *Supporter* be again ſupported by *Electricals per ſe*, it will only receive ſo much Electricity as will impregnate it, and then the

Virtue will go on to the End of the String, and impregnate the Bodies faſten'd to it.

12. The *Non-electricals* receive the greateſt Virtue at the End of the String, and moſt of all, if they are wet. But the *Electricals per ſe*, if long Bodies, as long Sticks of Wax, and Glaſs Tubes, only become electrical at the End next to the String.

13. *Electricals per ſe* will become *Non-electricals*, if they be wet, or only moiſten'd. Thus Supporters that tranſmit the Electricity immediately, ſtop it when wet with a Sponge, or when blown through, if open Tubes. And if the long *Electricals per ſe*, hanging at the End of the Conductor, be made wet, they will become *Non-electricals*, and ſtrongly receptive of the Virtue given by the rubb'd Tube at the other End of the String.

*N.B.* All the ſix Experiments mention'd in the Beginning of this Paper, confirm this Obſervation.

14. A *Non-electrical* having been impregnated with Electricity by the rubb'd Tube, is repell'd by it, till it has loſt its Electricity by communicating it to another *Non-electrical*. Then being in its firſt State, it is again attracted by the Tube, which holds it till it has fully impregnated it; then it repels it again. This is evident, by attracting a Down Feather by the Tube in the Air, and then repelling it; ſo as to make it dance backwards and forwards to and from a Finger held up at a Foot or two from the Tube. But the Thing appears more plainly from the following

## EXPERIMENT VII.

Having rubb'd the Tube *Tt*, (ſee TAB. I. Fig. II.) and with it attracted a Feather, the Feather at *t* was repell'd from the Tube, whenever it was brought near it; but ſuddenly dipping the End *T* of the Tube in Water, the Feather floating in the Air came to it again, and ſtuck to the End of the Tube at *T* or near *F*.

*N. B.* In fair Weather this Experiment will not ſucceed, unleſs the Tube be thruſt pretty deep into Water (a Foot at leaſt); but in moiſt Weather an Inch or two will do.

*P. S.* Though animal Subſtances be generally thought to be *Electrical per ſe*, yet it is only when they are very dry: This is the Reaſon why a living Man ſuſpended by a Hair Rope, or ſtanding upon a Cake of Reſin, to receive Electricity from the Tube, muſt be conſider'd as a *Non-electrical*, by reaſon of the Fluids of his Body.

*N. B.* The above Obſervations, together with the *Queries* in my former Papers, will be further illuſtrated by ſome Experiments which I do not now mention, becauſe I have only try'd them at home; but when I have try'd them before the ROYAL SOCIETY, I ſhall give an Account of them in Order.

## X. *An Account of ſome* Electrical Experiments *made at his* ROYAL HIGHNESS *the* PRINCE *of* WALES's *Houſe at* Cliefden, *on* Tueſday *the* 15*th of* April 1738. *where the* Electricity *was conveyed* 420 *Feet in a direct Line. By the Same.*

HAVING heard that Electricity had been carried along an hempen String five or ſix hundred Foot long, but having only ſeen it when the String was carried backwards and forwards in a Room by Silk *Supporters*, I was willing to try it with a Packthread String ſtretch'd out at full Length; for which Purpoſe having join'd a Cat-gut String of ſix Foot long, I faſten'd it to the Inſide of a Door in the Suite of Rooms at *Cliefden*; and having alſo tied another Cat-gut, like the firſt, to the other End of the String, I tied it up to the Inſide of the Door at the other End of the Houſe; but at the Place where the Packthread was join'd to the Cat-gut, I left a Foot and an half of Packthread hanging down, and faſten'd to it a *Lignum Vitæ* Handle of a Burning-Glaſs. Then applying a rubb'd Tube at the other End of the String, I made the Electricity run to the *Lignum Vitæ*, but with ſome Difficulty, which I attributed to the Size, being an animal Subſtance that ſtill ſtuck to the Packthread as it was new; therefore I caus'd the Packthread to be wet with a Sponge from one End to the other, to waſh off the Size: Then was the Electricity from the Tube communicated very ſoon and very ſtrongly; for the

Thread of Trial (mention'd in my former Papers) was drawn by the *Lignum Vitæ* at the Diſtance of a Foot.

Afterwards having join'd more Packthread together, made a String of four hundred and twenty Foot long, one End of which I faſten'd (by the Interpoſition of Cat-gut as before) to the Iron Gates in the Garden, before the Houſe, and the End which had the *Lignum Vitæ* Handle, to the upper Part of the Door next to the Back-ſide of the Houſe in a large Drawing-Room, taking care that the String came through the middle of the open'd Doors through which it paſſed; and to prevent this String dragging upon the Ground, three Pieces of Cat-gut held acroſs by two Men, at equal Diſtances from the Ends, and from each other, ſupported it. The String was altogether dipp'd in a Pail of Water, before the Experiment; but great Care taken, that the Cat-gut ſhould not be wet.

Then I applied the rubb'd Tube at the End in the Garden, whilſt my Aſſiſtant held the Thread of Trial near the Handle above-mention'd, which Thread was ſtrongly attracted, though the Wind was very high, and blow'd in the contrary Direction to that in which the Electricity ran along.

I firſt tried the Experiment with the Packthread dry, but then it would not do at that Diſtance.

*N. B.* The Weather was moiſt when I made the Experiment.

# XI. Obſervationes Botanicæ, *Plantarum quarundam Deſcriptiones accuratiores exhibentes*; *per D$^{r}$.* Paulum Henricum Gerhardum Moehring, *M. D. factæ*; *ad Illuſtriſſimum D$^{n}$.* Hans Sloane, *Bart.* R. S. *Præſ. miſſæ.*

## I.

### SALICORNIA *ramis clavatis, ſquamis articulorum adpreſſis.*

P*LANTA* annua, quoad omnes partes ſucculenta, 8. 9. digit. Rhenan. raro pedem Rhenan. alta.

RADIX e multis fibris filiformibus conſtat.

CAULIS ramoſus, tereti-compreſſus parum, ad radicem lignoſus & rugoſus, ſupra ſucculentus, glaber, aphyllus, clavatus: *Clavis* oppoſitis, alterno ordine e productionibus auriculatis, ſquamatis, vaginantibus, arcte adpreſſis, caulis primarii erumpentibus, $\frac{1}{2}$, 1. ad 1 $\frac{1}{2}$ dig. Rhen. longis, ſuprema terminatrice reliquis longiore.

FRUCTIFICATIO e *Floſculis* ternis, figuram trianguli birectanguli ſphærici, cujus baſis ſurſum convexa eſt, repræſentantibus, alterno ordine ſibi oppoſitis, conſtat. His fructificationibus triangularibus omnes clavæ ſecundum longitudinem obſitæ ſunt.

Inſidet cuilibet commiſſuræ ramulorum ſquamato-denticulatæ, ſubacutæ, *denticulo* inſtar receptaculi totius fructificationis ſerviente, ac infima ſtamina occludente.

CALYX eſt productio ſcapi ſquamata, marceſcens quocum unum planum efficit;

*Floſculi ſuperioris*, & quaſi intermedii, rhomboi-
us, angulo inferiori rectilineo acuto; Angulo ſupe-
ri curvilineo obtuſo;
*Floſculorum duorum inferiorum*, aut, ſi mavis, late-
ium, Trigonus, baſi parum latiore.

COROLLA nulla.

STAMINA Duo, ſupra & infra germen oppoſito ſitu,
iſdem baſi adfixa, & e rimula calycis prominula:
perius primum exſurgit; quo delapſo, inferius pro-
: (Unde factum eſt, ut omnes Botanici unum
odo ſtamen eidem adſcribant).

*Filamenta* filiformia, intra calycem abſcondita.

*Antheræ* oblongæ, erectæ, extra calycem hiantes,
dymæ, (inde fit, ut primo ſubtiliori adſpectu parvum
rpus tetragonum præ ſe ferant) extrorſum concavæ,
teribus introrſum longitudinaliter convolutis, cum
amento æqualis longitudinis, eidem in ſummo
rimque adhærentes, arcteque illud obtegentes, baſi
a plerumque intra foveolam calycis incluſæ. In
ncavitatem iſtam multum farinæ genitalis delabitur.

PISTILLUM, *Germen* ſubrotundo-acuminatum, in
edio filamentorum ſitum, intra calycem abſconditum,
uſdem cum filamentis longitudinis.

*Stylus* nullus. *Stigma* capillare, acutum.

PERICARPIUM *Capſula* veſicaria, inflata, ovato-acu-
inata, exacte referens calyptram polytrichi DILLENII,
d deorſum magis ampullatam, intra calycem latens.

SEMEN unicum, ovato-compreſſum, horizontaliter
capſula ſitum, a baſi ad medium ſulcatum, tenuiſ-
ni ope *pedicelli* coſtæ caulis adfixum.

OBSERVATIONES.

*a.* Creſcit heic locorum ubique ad oceani Septemtrionalis litus, dummodo terra pinguis, argillacea (noſtratibus *Schlick* vocata) adſit, & magnis fluxibus maris aqua ſalina interdum conſpergi poſſit. Simul ac vero terra aggere circumvallatur, & maris undis ſubtrahitur, ſicque ſalis marini nutrimento privatur, ſequenti ſtatim anno diſparet.

*b.* Adhibetur inter acetaria, refrigeranti ſapore ſe commendans.

*c.* Floret *Auguſto*, ſemina perficit *Septembri* & *Octobri*. Plantulæ prodeunt fine *Aprilis*, & initio *Maii*: His cotyledones tereti-oblongæ, ſucculentæ.

*d.* Ergo pertinet in *Syſtemate Sexuali* LINNÆI ad *Diandriam Monogyniam*.

(*e.*) Alia haut ita pridem ſpecies *Saltzdahlenſis*, *Ducatus* ſcilicet *Brunſvicenſis*, nobis, ſiccis ſpeciminibus, miſſa eſt a D. D. FRANC. ERN. BRUCKMANNO, quæ longe diverſa a noſtra, adpellari poſſet *Salicornia, ramis imbricatim pyxidatis, ſquamis articulorum exſtantibus*, propoſitaque a variis auctoribus videtur.

(*f.*) Tandem, genus *Salicorniæ* a nullo hactenus Botanico curate ſatis enodatum fuiſſe patet, teſte fragmento amiciſſimi LINNÆI *Charact. Gener. Plantar. & Hort. Cliffort.* ſua enarrantis ex incompletis TOURNEFORTII ac MAGNOLII adumbrationibus.

## II.

## VERBASCUM *foliis cordatis crenatis acutis glabris: floralibus ternis.*

PLANTA biennis, ſecundo anno florens, caule 7, 8, pedes alto.

CAULIS plerumque ſimplex, nonnumquam in-
rne ramoſus, longiſſimus, erectus, teres, breviſſimis
lis villoſus, læte viridis, inferius valde folioſus, ſupe-
us ab initio florum emergentium parvis foliolis ſti-
tus.

FOLIA *primi anni* & *Caulis inferiora* ſeſſilia, ſemi-
nplexicaulia, cordata, in acumen lanceolato-lineare
utum terminata, mollia, glabra, margine crenato,
entato: denticulis inæqualibus.

*Floralia* terna, lanceolato-linearia, acuta, parva,
edio infimo duplo triplove longiori.

FLORES plerumque quaterni ex eodem ſinu: in
ummo caulis unicus, reliquis ſuffocatis.

PEDUNCULUS breviſſimus, calyce triplo fere bre-
ior, craſſus, ſimplex.

CALYX. *Perianthium*, ut in *Linn. gen. pl.* ad baſin
ere quinquepartitum: *laciniis* lanceolato-linearibus,
irſutis.

COROLLA. *Petalum*, ut *Linn. gen.* 153.

STAMINA. *Filamenta* 5. ſubulata, corolla breviore:
*ribus ſuperioribus* reliquis brevioribus, circumcirca
anuginoſis: *duobus infimis* reliquis tertiam partem
ongioribus, declinatis, ſurſum incurvatis, in medio
nterni lateris lanuginoſis.

*Antheræ trium breviorum* filamentorum triangu-
ariter incumbentes, adpreſſæ, planæ, ſexangulares:
*uorum longiorum* filamentorum rectanguli figura in-
umbentes, adpreſſæ, planæ, ſexangulares.

PISTILLUM *Germen* ſubrotundum. *Stylus* filifor-
is, inclinatus, ſtaminibus parum longior, marceſcens.
*tigma*, ut *Linn. gen.*

PERICARPIUM *Capſula* ſubglobosa, tranſverſim a ſum-
o ad baſin biſulcata, bilocularis, *&c.* ut *Linn. gen.*

*Involucrum* hujus exterius eſt calyx erectus, fructum amplectens.

Semina Numeroſa, oblongo-quadrangularia, truncata, minutiſſime rugoſa, parva. *Receptacula,* ut *Linn. gen.*

Obſ. *a.* Ergo quoad plurimas fructificationis partes ſimillimum exſiſtit Verbaſco quinto Linn. *Hort. Cliff. p.* 55. in reliquis differt.

*b.* Corollarum color flavus, unguibus maculatis, purpureis: filamenta interne purpurea: horum lanugo partim purpurea, partim alba.

*c.* Semina vere 1738. ab optumo Linnæo titulo *Verbaſci e Virginia* miſſa, cum plurimis aliis noviter ex *America* advectis, atque ad Illuſtr. Dom. Ge. Clifford tranſmiſſis, plantas modo deſcriptas largita ſunt, quæ hyeme ſolo ſub tecto conſervandæ apud nos videntur.

(*d.*) Flos tota æſtate matutinis horis apertus.

*e.* Ergo Verbaſcum annuum, foliis oblongis ſinuatis obtuſis glabris. Linn. *Hort. Cliff.* 55. melius circumſcribetur hoc nomine: Verbascum *foliis oblongis ſinuato-crenatis obtuſis glabris, florali unico.* Cujus differentia ſpecifica potiſſimum in his conſiſtit: *Folium florale* ovato-acuminatum, unicum. *Flos* unicus. *Pedunculus* longiſſimus, filiformis, calyce triplo longior. *Calyx* ſub fructu plano-expanſus.

### III.

Senecio *foliis pinnatifidis lacinulatis: laciniis omnibus laxis patentiſſimis linearibus acutis.*

Jacobæa altiſſima, foliis crucæ artemiſiæve ſimilibus & æmulis. Rupp. Jen. 142.

*Caulis* humanæ altitudinis, teres, leviſſime angu-
us, ſtrigoſus, glaber.

*Folia* alterna pinnatifida, glabra, laciniis æquali-
s, linearibus, patentiſſimis, laxe lacinulatis, apicibus
tis, rachi lineari : color ſaturate viridis, inferiori
te parum pallidior.

*Corollæ* radii flavi, magni, mox revoluti.

*Calycis* in baſi foliola reliquis adpreſſa.

Obſ. *a.* Dixi hanc plantam, Jena miſſam, Seneci-
em, ſecundum characterem, a LINN. *gen. plant.*
7. datum.

*b.* Ergo ſpecie diverſa a LINNÆI Senecione foliis
nnato lyratis, lacinulatis. *Hort. Cliff.* 406.

## IV.

LECEBRUM *Linn. Corollar. gen.* 947. *Rupp. Jen.*
79. Corrigiola *Dillen. Giſſ. Supplem. adpend.* 167.

CALYX *Perianthium* pentaphyllum, carnoſum, *foli-*
*is* craſſis, erectis, compreſſis, introrſum ad ſummum
re excavatis, perſiſtentibus, ſeta infirma terminatis.

COROLLA. Nulla.

STAMINA. *Filamenta* quinque triangulari-ſubulata,
uctu breviora, intra calycem. *Antheræ* rotundulæ,
ectæ, ſimplices.

PISTILLUM. *Germen* ovato-acutum, calyce dimidio
re brevius. *Stylus* nullus. *Stigma* ſimplex, turgidum,
btuſum.

PERICARPIUM. *Capſula* membranacea, tenuiſſima,
vata, utrimque acuminata, ſimplex, univalvis, ſuperne
ehiſcens, calyce tecta.

SEMEN. Unicum, ovatum, utrimque acutum, maxu-
um, nitidum.

Obſ. *a.* Ergo pertinet in *Syſtem. Sexual.* LINNÆI ad *Pentandriam Monogyniam*, commodeque poſt *genus* 94. *Achyranthis* collocabitur.

*b.* Obſervatio tribus annis repetita hæc docuit, quum plantula humifuſa copioſe apud nos in arenoſis humidis proveniat.

## V.

## RUPPIA *foliis linearibus obtuſis.*

PLANTA aquis marinis innatans, flexuoſa, perennis.

RADIX ramoſa, faſciculos foliorum emittens; *corpus* teres, geniculatum, repens, brunnum, ſolidum, craſſitie pennæ circiter columbinæ, aut parum tenuius; *fibrillæ* capillares ſimplices, e geniculis tantum prodeuntes, unciam unam alteramve longæ, albicantes.

*Faſciculi caulini*, culmi graminei ſpecie, ſinguli e ſingulis radicalibus ramulis prodeunt, compreſſi, laxe geniculati, glabri, valde infirmi, flexiles, natantes, aquave marina refluente, argillæ incumbentes, e quolibet geniculo vaginato, alterno ordine, ramos compoſitos emittentes.

*Folia vaginantia*, alterna, linearia, verticaliter obtuſa, oblonge parallelogramma, glabra, mucoſa, ſaturate viridia, baſi geniculis caulinis infixa, ramulos cum horum foliis, narciſſorum inſtar, includunt. Verſus extremitatem cujuſlibet ramuli 2, 3, 4 folia, ſitu parallelo, unicæ vaginæ includuntur.

*Foliis vaginatis* omnibus fere, ipſo caule longioribus, *fructificationes* ea quidem lege inſunt, ut hæ in dimidia inferiori ejus parte intra rimulam compreſſam abſcondantur. Supra & infra fructificationis

lineam

eam geniculum tranſverſe ſulcatum eſt, hanc a pe- olo infra, & a reliquo folio ſupra diſtinguens.

CALYX, *Involucrum univerſale, vagina ſpathæ* vices pplens, in dimidia inferiori folii parte, introrſum ma media longitudinali, cujus latus unum ab altero iquantum obtegitur, hians.

*Spadix* intra involucrum, membranaceus, albidus, ompreſſus, obtuſus, lateribus longitudinaliter parum onvolutis, medio leviter carinato, dorſum involucri ectans, longitudine $\frac{3}{4}$ involucri, aut parum longior, umquam hujus finem adtingens, fructificationes 9. d 13. diſtice in longitudine obliqua fovens.

COROLLA Nulla.

*Filamenta* nulla. *Antheræ* ſolitariæ, ante flore- centiam intra involucrum latentes, ovato-oblongæ, trimque ſubacutæ, oblique adſcendentes & diſtice ecundum longitudinem ſpadici ita adhærentes, ut nunc nam, nunc duas antheras unicum piſtillum eodem n plano excipere videatur, ſingulis tamen antheris ingula piſtilla vere adſint, modo abſcondita, modoque iſui obvia. At explicatæ, (*i. e.* durante floreſcentia) b alis ſuis lateralibus, claſticis, membranaceis, pel- ucidis, expanſis in figuram naviculæ concavam incur- antur, carina deorſum prominente, & piſtillis ita uperimponuntur, ut diſtracta utrimque, patulaque acta involucri rima, ima ſui parte ſurſum horizon- aliter adſcendant, atque navicularum concavarum pecie ſecundum longitudinem extrorſum pateant. orpus antherarum flavum & mucoſum eſt, quod acile abſtergi poteſt.

PISTILLUM *Germen* intra involucrum, oblongum, d baſin, qua ſpadici adfigitur, parum amplius. *Stylus* tra involucrum, ſimplex, filiformis, ſurſum recurvus, perſiſtens, poſt floreſcentiam cum ſpadice parallelus, & parum curvus. *Stigmata* duo, tenuiſſima, capillaria, ab invicem diducta, extra involucrum horizontaliter exporrecta, cito marceſcentia & evanida (ut relicta hinc macula e ferrugineo-nigricans facile alicui imponere poſſit, ſtigma modo unicum eſſe).

PERICARPIUM; *Cortex* tenuis, membranaceus, cylindraceus, baſi obtuſus, apice ſtylo munitus, ſtylo parum longior, cum ſpadice parallelus, baſi liber; ad finem ſtyli ſpadici adfixus, pedicelli ope breviſſimi.

SEMEN In quolibet cortice ſolitarium, cylindraceum, utrimque obtuſum, longitudinaliter ſubtiliſſime ſtriatum, album.

Ergo pertinet in LINNÆI *Syſtem. Sexual.* ad *Gynandriam Monandriam*, minime vero ad Gynandriam Polyandriam ejuſd. *ibid.* In *fragment. meth. nat.* LINN. *p.* 506. *Claſſium plantar.* ad *ordinem* XLVIII. quo & *Naias*, & *Zannichellia* referendæ videntur: In ROYENI *Syſtem.* ad *Palmas*, *Spatha bifida*. Vid. *Ejuſd. Flor. Leyd. Prodr. p.* 9.

Creſcit in aqua marina ad inſulam *Wangeroogenſem*, & reliquas ad ſinum illum Oceani Septemtrionalis, *Wadt* dictum, ſitas inſulas. Durante aquarum adfluxu, eidem innatat; refluxo autem mari, argillæ tenaci, cui radix infigitur, incumbit.

Mirum, plantam adeo vulgarem locis maritimis, cujus folia (quæ ſicca, papyri inſtar, alba, nigra, etiam evadunt) menſibus Auguſto & Septembri a maris fluctibus ad littora abundanti copia rejiciuntur, a nullo, quantum memini, niſi forte Anglo botanico, deſcriptam aut depictam eſſe. Ruppiæ generi inſerenda videtur, ſi hujus character, amiciſſimo LINNÆO non niſi ad ſiccum exemplar, ut ſignum †, in *generi-*

*bus*

*plantar.* adjectum docet, examinatus, parum am-
tur. An malint alii novum genus?

## VI.

## HIPPURIS. *Linn. gen.* 1.

*alyx*, Nullus.
*orolla*, Nulla.
*tamen*, *Filamentum* unicum, ſubulatum, craſſiuſcu-
, deciduum, longitudine fere antherarum, germini
lens. *Anthera* didyma, quolibet ſegmento a
o biſulcata, germine & filamento parum longior,
a, carnoſa.
*iſtillum*, *Germen* oblongum, infra ſtamen. *Stylus*
cus, filiformis, tenuis, erectus, acumine extrorſum
xus, introrſum ad latus ſtaminis ex apice germinis
ndus, ſtamine longior, marceſcens. *Stigma* acu-
num.
*ericarpium* Nullum.
*men* Unicum, oblongum, nudum, duriuſculo te-
ne abſcondens nucleum parvum.
bſ. 1. Floret Jun. & Jul. fructum perficit Auguſt.
embr. creſcit abunde in foſſis *Jeveranis*, prope
*dam Friſiæ Orientalis*, &c.
Variat *ſtaminibus rubellis*, quæ copioſior; &
locis *ſtaminibus albidis*, herbaceis, quæ rarior.
Ergo margines illi, a LINNÆO *gen.* 1. ſub
e deſcripti, ſunt veræ antheræ, nec aliud quid-
bona lente detegendum.

*Vide* TAB. I. Fig. *A. B. C.*

FIGURARUM, ſub lente Muſſchenbrœckiana a me delineatarum, explicatio.

Fig. A. *Flos antice viſus, ut filamentum adpareat.*
*a.* Filamentum.
*b.b.* Antheræ, antice viſæ.

Fig. B. *Flos a tergo pictus, ut piſtillum conſpiciatur.*
*c.c.* Antheræ, poſtice viſæ, ut ſulci in conſpectum prodeant.
*d.d.* Germen.
*e.* Stylus cum ſtigmate.

Fig. C. *Semen.*
*f.* Semen fere maturum.
*g.* Stylus marceſcens, ſupra ſemen reflexus.

## XII. *Obſervatio* Anthelii Vitembergæ *ſpectati*; *per* J. Fried. Weidlerum *Matheſ. Prof. ibidem Primar.* & R. S. Lond. *Soc. communicata, in Epiſtola ad* C. Mortimerum, R. S. *Secr.*

DIE $\frac{18}{7}$ *Januarii* A. 1738. quidam ex auditoribus meis, cum ante meridiem in campo prope *Vitembergam* agros dimetiretur, forte fortuna Anthelium, ſive Solis imaginem e regione Solis veri verſus ſeptentrionem poſitam conſpexit. Nimirum mane hora 8 cœlum undique ſerenum, mox circa horam 9, e ſeptentrionali plaga, nubes exoriuntur, ibique ſenſim

iſim & paullatim condenſantur, temporis progreſ-
hæ in meridiem ulterius ſeſe explicabant. Hora
min. 30. cum nubes obſcuræ fere verticem atti-
ſent, apparuit in illis Sol Soli oppoſitus, pari ma-
itudine, rotundus, admodum ſplendidus, ut oculi
s lucem ferre non poſſent, corona ſive halone
li cinctus. Diameter coronæ major, Solis circiter
metros quinque, minor tres capiebat: Ipſa corona
ro flavoque coloribus exornata, parte rubra in
thelium verſa: Tractus nubium, reliquus intra
onam flaveſcebat, hinc inde etiam rubebat. In
thelio decuſſatim ſeſe ſecabant duæ iridis por-
nes, ſub angulo 60 fere graduum, utrimque in
um & occaſum flexæ, & ad coronæ ovalis peri-
eriam continuatæ: Quales A. 1661. D. 6. Sept.
*velius* quoque cum Anthelio vidit, quemadmodum
tractatum de Mercurio ſub Sole p. 176. narrat.
rabat ſpectaculum per horæ quadrantem; cum
im nubes in meridiem longius extenderentur, &
lem verum occultarent, Anthelius evanuit. Ningit
tea parum hora undecima: Mane lenis ventus ex
dia inter meridiem & occaſum plaga ſpirabat.
figuram ab ipſo ſpectatore mihi exhibitam, in
B. II. Fig. 1.

XIII. *Oc-*

## XIII. *Occultatio* Palilicii, A. 1738. *d.* 23. Decembris *St. N. obſervata a D.* Chriſtfried Kirchio, *Aſtronomo Regio*, Berolini. *Ex literis ad* J. F. Weidlerum *datis excerpta.*

| | Tempus horolog. oſcillat. H. M. S. | | Partes microm. Tubo 4. ped. | Valor partium microm. ′ ″ | Tempus correctum. H. M. S. | Tempus correctius. H. M. S. |
|---|---|---|---|---|---|---|
| 1 | 6 56 37 | ✱ a centro *M. Sinai* | 38 | 15 21 | 6 24 37 | |
| 2 | 6 58 30 | ✱ a centro *M. Sinai* | 34 | 13 42 | 26 30 | |
| 3 | 7 3 54 | Immerſio ſtellæ | | | 6 31 54 | 6 32 00 |
| 4 | 8 5 29 | Emerſio ſtellæ tub. 9 ped. | | | 7 33 29 | 7 33 33 |
| 5 | 5 35 | Emerſio certo facta | | | 7 33 35 | |
| 6 | 6 43 | ✱ a centro *M. Sinai* | 36 | 14 32 | 34 43 | |
| 7 | 15 32 | ✱ a prox. marg. Lunæ | 8 | 3 14 | 43 32 | |
| 8 | 20 | ✱ a *M. Sinai* | 46½ | 18 47 | 48 | |
| 9 | 28 | Diameter Lunæ | 74 } | 29 73 | 56 | |
| | | vel | 73½ } | 29 41 | | |
| 10 | 29 12 | *M. Sinai* a prox. marg. ☾ | 8 | 3 14 | 7 57 12 | |
| 11 | 38 | Diameter ☽ ſub. 9 ped. | 99½ | 29 38 | 8 6 | |
| 12 | 42 | Diameter ☽ ſub. 7 ped. | 75 | 30 | 10 | |
| 13 | 46 55 | ✱ a *M. Sinai* | 72 | 29 5 | 14 55 | |
| 14 | 8 48 | Diameter Lunæ | 73½ | 29 41 | 8 16 | |

Vide SCHEMA hujus Occultationis in TAB. II. Fig. 2.

### *Situs ſtellæ reſpectu macularum lunarium ſequenti modo obſervatus.*

I. Ante obſervationem (1.) h. 6. 20′. notavi ſtellam in linea recta a meridionali margine Inſulæ Macræ (Poſidonii) per ſeptentrionalem partem Ponti Euxini, (medium maris Serenitatis) & M. Ætnam (Copernicum) producta: & linea a M. Sinai ad ſtellam fere ſtringebat littus ſinus Sirbonidis. (M. Humorum).

II. Tem-

. Tempore obſervationis, (1.) ſtella erat in linea
a a lacu nigro majore (Platone) per partes ori-
les inſulæ Cercinnæ (a Keplero verſus ortum)
ducta.

I. Tempore obſervationis (2.) ſtella in linea per
ium Paludis Mæotidis & medium M. Adriatici
M. Criſium & S. medium) continuata.

V. Tempore immerſionis ſtellæ, ſequentes lineæ
æ ad illam coincidebant, & locum peripheriæ
aris, ubi ſtella occultabatur, deſignabant.

1. A littore Pontus Euxini (M. Serenitatis) verſus Cæciam ſpectante, per M. Ætnam (Copernicum).
2. A littore ſinus Apollinis, per loca paludoſa (ſc. a littore S. Iridum, per Keplerum).
3. A M. ~~Sinai (Tychone)~~ per littus meridionale S. Sirbonis (M. Humorum).

V. Emerſio ſtellæ contigit e regione M. Paropa-
ſi, (Furnerii) & in linea recta a lacu nigro majore
atone) per Byzantium (Menelaum) producta, quæ
ngebat ſinum extremum Ponti (M. Nectaris).

VI. Tempore obſervationis (7.) M. Porphyrites,
riſtarchus) margo ſeptentrionalis L. Theſpitis (Fra-
torii) & ſtella in linea recta.

VII. Tempore obſervationis (8.) Lacus Hyperboreus
perior (Hermes) medium Paludis Mæotidis (M.
iſii) & ſtella in linea recta.

Oc-

## *Occultatio Palilicii obſervata* Vitembergæ Saxonum, d. XXIII. Dec. *St. N. A.* CIↃDCCXXXVIII. *a* Jo. Friderico Weidlero, R. S. Lond. S. *&c.*

| | | | |
|---|---|---|---|
| Immerſio | 6. | 27. | 35. |
| Emerſio | 7. | 29. | 20. |
| Duratio | 1. | 1. | 45. |

### ANNOTATIONES.

1. Obſervatio a duobus ſpectatoribus ſimul peracta; ego tubo aſtronomico IX pedum utebar, amicus & ſocius obſervationis per teleſcopium IV pedum lunam contuebatur.

2. Immerſio & emerſio facta in inſtanti: uno tamen prope minuto horario citius per longiorem, quam per breviorem tubum animadverſa.

3. Appulit ſtella ad marginem lunæ orientalem, circa gradum 163. ſchematis lunæ plenæ mobilis Heveliani, Selenographiæ, p. 364. emergebat circa gradum 272. ejuſdem ſchematis. Itaque linea recta, puncta immerſionis & emerſionis copulans, ſtringit extrema maris Humorum & Nubium & inter Pitatum & Mare Nubium tranſit.

Cœlum tempore immerſionis ſerenum non erat, ſed tenues nubeculæ ſemper fere ante lunam & ſtellam oberrabant: ideoque figura ſtellæ oblonga, diu ante occultationem, per atmoſphæræ vapores ſpectabatur.

## V. *Eclipſis Solis obſervata* Vitembergæ Saxonum, *die* IV. Aug. *St. N. die* XXIV. Julii *St. Vet. A.* CIƆDCCXXXIX. *poſt merid. a* Jo. Friderico Weidlero.

*Phaſes creſcentes.*

| | Hor. | Min. | Sec. *p. m.* |
|---|---|---|---|
| nitium | 4. | 15. | 30. |
| Digitus I. | | 22. | 00. |
| Digiti II. | | 29. | 30. |
| III. | | 35. | 30. |
| IV. | | 40. | 00. |
| V. | | 47. | 30. |
| VI. | | 55. | 40. |
| VII. | 5. | 2. | 00. |
| VIII. | | 9. | 00. |
| IX. | | 24. | 40. |

*Phaſes decreſcentes.*

| | | | |
|---|---|---|---|
| VIII. | 5. | 35. | 30. |
| VII. | | 43. | 40. |
| VI. | | 50. | 30. |
| V. | | 56. | 00. |
| IV. | 6. | 2. | 45. |
| III. | | 8. | 40. |
| II. | | 14. | 00. |
| I. | | 20. | 45. |
| Finis | | 27. | 20. |

Vide Typum hujus Eclipſeos ad Fig. 3. TAB. II.

Ad

## Ad FIGURAM 4. TAB. II.

*Obſervatio* Immerſionis & Emerſionis *macularum, quæ tempore eclipſeos in diſco ſolis conſpicuæ fuerunt.*

| IMMERSIONES. | | H. | M. | S. |
|---|---|---|---|---|
| Appulſus Lunæ ad maculam | (*a*) | 4. | 34. | 35. |
| Tegitur tota macula | (*a*) | 4. | 34. | 45. |
| Appulſus Lunæ ad maculam | (*d*) | 5. | 1. | 30. |
| ——————ad maculam | (*e*) | 5. | 5. | 20. |
| ——————ad maculam | (*b*) | 5. | 7. | 15. |
| Immerſio totalis | (*b*) | 5. | 10. | 00. |
| Appulſus Lunæ ad maculam | (*c*) | 5. | 16. | 30. |
| Tegitur tota macula | (*c*) | 5. | 18. | 00. |
| EMERSIONES. | | | | |
| Incipit emergere macula | (*b*) | 5. | 30. | 50. |
| Medium emerſionis | (*b*) | | 32. | 30. |
| Emerſio totalis | (*b*) | | 34. | 00. |
| Emerſio incipiens maculæ | (*c*) | | 39. | 00. |
| Medium emerſionis | (*c*) | | 39. | 50. |
| Emerſio totalis | (*c*) | | 40. | 40. |
| Emerſio incipiens | (*a*) | | 41. | 00. |
| Emerſio totalis | (*a*) | | 41. | 40. |
| Emerſio | (*d*) | 6. | 4. | 30. |
| Emerſio | (*e*) | | 6. | 15. |

### ANNOTATIONES.

1. FIGURA 3. TAB. II. Siſtit ſolis diſcum recto ſitu, qualem helioſcopium foris adſpicientibus oſtendit.

2. FIGURA 4. TAB. II. Repræſentat maculas ſolis eo ſitu, quem ſub principium deliquii habuere, quarum immerſio & emerſio durante eclipſi obſervata fuit.

3. Luna ſubiit ſolem circa gradum 102. a Zenith computatum: diſceſſit a ſole circa 53. gradum, ab eodem Zenith numeratum.

4. Tempore maximæ obſcurationis lunæ orbis non plane niger, ſed puniceo colore tinctus per teleſcopium apparuit. Maculæ tamen lunæ diſtingui non poterant.

5. Margo lunæ, parte ſiniſtra, quæ in meridiem vergebat, circa tempus maximæ obſcurationis, montium jugis diſtinguebatur, qui etiam in imagine, per teleſcopium picta, cernebantur. Reliquus margo ſub ſole conſpicuus æqualis.

6. Durante tota eclipſi Lunæ peripheria nuda apparuit, abſque nebula, vel nube, quæ in aliis quandoque eclipſibus eidem imminet. Circa finem tamen, cum unus circiter ſolaris diſcum digitus adhuc occultaretur, motus lucis ſolaris vehemens in margine Lunæ aſpero notabatur.

7. Denique prætermittendum non duco, quod amicus, harum rerum probe gnarus, qui per Teleſcopium Aſtronomicum IX pedum ſolem intuebatur, circa hor. IV. 31 min. in obſcuro Lunæ diſco lucem aliquam, inſtar fulguris, celeriter huc illuc in tenebris diffuſam, animadverterit: & quod idem obſervator irca horam V. min. 50 toti adſtantium coronæ affirmaerit, a ſe tum ter talia fulgura ſubito enitentia iterum onſpecta fuiſſe.

## XV. *Part of a Letter from Mr.* J. Derby *to Mr.* Henry Sheppard, *concerning a terrible* Whirlwind, *which happen'd at* Corne Abbas *in* Dorſetſhire, Oct. 30. 1731. *communicated to the* ROYAL SOCIETY *by* Edmund Halley, *LL. D. V. Pr.* R. S. *and Aſtronom. Reg.*

ON *Saturday* the 30th of *October* laſt paſt, about a Quarter before One in the Night, there happen'd at *Corne-Abbas*, *Dorſetſhire*, a very ſudden and terrible Wind Whirl-puff, as I call it: Some ſay it was a Water-ſpout, and others a Vapour or Exhalation from the Earth; but be it of what Name it will, it began on the South-weſt Side of the Town, carrying a direct Line to the North-eaſt, croſſing the Middle of the Town in Breadth two hundred Yards. It ſtripped and uncovered tiled and thatched Houſes, rooted Trees out of the Ground, broke others in the midſt of at leaſt a Foot ſquare, and carried the Tops a conſiderable way. The Sign of the new Inn, a Sign of five Foot by four, was broke off ſix Foot in the Pole, and carried croſs a Street of forty Foot Breadth, and over an oppoſite Houſe, and dropp'd in the Backſide thereof. It took off and threw down the Pinacles and Battlements of one Side of the Tower; by the Fall of which, the Leads and Timber of great Part of the North Alley of the Church was broke in. The Houſes of all the Town were ſo ſhock'd, as to raiſe the Inhabitants; no hurt was done but only acroſs the Middle of the Town in a Line. No Life loſt, but Three had a very providential Eſcape. 'Tis computed by judicious Workmen, that the Damage ſuſtain'd by this Accident amounts to Two hundred Fifty-eight Pounds, and upwards. It is very remarkable, it only affected, as I have related: no other Parts of the Neighbourhood or Country ſo much as felt or heard it. It is ſuppoſed by the moſt Judicious, that it began and ended within the Space of two Minutes. 'Twas ſo remarkably calm a Quarter after Twelve, that the Exciſeman walked through two Streets, and turned a Corner, with a naked lighted Candle in his Hand, unmoleſted and undiſturbed by the Air; and as ſoon as over, a mighty Calm, but ſoon followed by a prodigious violent Rain. If this Fact be worth relating, I ſhould be glad to know amongſt the Learned, what it might be called, or, if to be known, from what Cauſe it might ariſe.

Mintern Magna,
Nov. 13. 1731.

*Your obliged Friend,*
*and moſt humble Servant,*

J. Derby.

# XVI. *An Account of* Letters *found in the Middle of a* Beech, *by* J. Theod. Klein, *Secretary of* Dantzick, F. R. S. *communicated to the* ROYAL SOCIETY *by Sir* Hans Sloane, *Bart. Pr. of the* R. S. *and Phyſician to His* MAJESTY, *&c. Tranſlated from the* Latin *by* T. S. *M. D.*

IN the Year 1727. a *Beech-tree* was fell'd near *Elbing*, for the domeſtic Uſe of *John Maurice Mœller*, then Poſt-maſter of *Elbing*, now Secretary of his native City. The Trunk being ſaw'd into Pieces, one of theſe, three *Dantzick* Feet ſix Inches long, cleft in the Houſe on the 30th of *June*, diſcovered ſeveral Letters in the Wood about one Inch and a half from the Bark, and near the ſame Diſtance from the Centre of the Trunk. The Hewer, having at one Stroke unfolded ſuch a Prodigy, and believing there was Witchcraft at the Bottom of it, ran in all poſſible Haſte for his Maſter: But this Gentleman, well inſtructed in ſound Philoſophy, gave Orders to preſerve the Pieces of Wood, and had them brought to my Study, at the ſame time communicating to me the Hiſtory, and his Sentiments thereon.

Figure 5. TAB. II. exhibits the Letters conſpicuous in the ſolid Wood, two of which, D B, ſhew their old Bark ſmooth and ſound. The Wood lying between the Letters and the Bark of the Trunk, as well as that between the Letters and the Heart of the Tree, is likewiſe ſolid and ſound, bearing not the leaſt

Trace of Letters. The Characters ᙠᗡ, being ſomewhat hollow, receive the Bark of the Letters D B *.

The ſame Letters are ſeen in the Bark of the Tree, only that they are partly ill-ſhaped, partly almoſt effaced, whereas thoſe within bear a due Proportion, as if done with a Pencil.

Now ſhould it be ask'd after what manner theſe Letters reach'd the Middle of the *Beech?* and how it came to paſs, that two of them, and no more, had their old dry Bark ſticking to them?

Both theſe Queries are anſwer'd by the Vegetation of Plants. But as this is not a proper Place to expound it, I will ſuppoſe it known, and thus briefly complete the Affair.

'Tis an ancient Cuſtom to cut Names, and various Characters, on the Rinds of Trees, eſpecially on ſuch as are ſmooth. That this has happen'd to our *Beech*, the mere Inſpection of the Bark commands our Affirmation †.

An Inciſion made, the *Tubuli* conveying the nutritious Juice, and the *Utriculi* in which it is prepared, are divided and lacerated, and more of them, as the Inciſion was made deeper and wider: and conſequently the Sap is not carried on in the Circulation, but extravaſated and ſtopped at the Wounds. Hence the Origin of the Characters in the Bark and Wood.

---

* *Daniel Barckholtz*, formerly *Cæſarean* Poet Laureat.

† The Characters, beſides D B, mark the Names of a noble Family, to which the Land, whereon the Tree was fell'd, formerly belong'd: *Reginæ*, *Dorothea*, *Michael*, *Gertrude*, *Joannes*, *Helwingii*.

Now as a new Circle of *Fibres* grows yearly on the Tree between the Wood and Bark, 'tis not impoſſible but a Number of theſe ſhould in a Proceſs of Years more and more ſurround the ingraved Characters, and at length cover them. And this Number was the greater in our *Beech*, on account of better than half a Century elaps'd ſince the Inciſion, which was made in the Year 1672. as appears on the Outſide of the Bark, as may be ſeen in the Figure. But while new Circles of *Fibres* are ſucceſſively added, the *Tunicle* or Skin of the Bark is broken each Time, and the *Utriculi* extended and dilated.

Wherefore 'tis eaſy, from what has been ſaid, to draw the Reaſon, why the Bits of Bark cut off on all Sides, in the Letters D B, had the ſame Fate with the Letters; why the Wood between the Bark and Letters was ſolid and ſound; and why the Shapes of the Letters bore a juſt Proportion in the Middle of the Wood, and not in the Bark.

So much for our *Beech*.

Now let us ſee, in few Words, what Authors ſay of ſuch figured Woods.

*Solomon Reiſelius, of Letters found within the very cleft Trunk of a* Beech, *Eph. Nat. Cur. Dec.* 1. *An.* 6. *Obſ.* 4. has at length, though with ſome Difficulty, gueſs'd the genuine Cauſe from frequent Examples of Inciſions.

But *Joannes Meyerus, on a Thief hanging from a Gibbet, drawn by Nature's Pencil in a* Beach, *Eph. N. C. Dec.* 3. *An.* 5. *Obſ.* 29. and *Joannes Petrus Albrechtus, on a certain rare Figure ſeen in a* Beech, *Eph. ibid.* aſcribe it to a Sport of Nature, and give this Reaſon; becauſe they could not diſcover the leaſt Sign of Impoſture, the deep Situation of the Figures hindering them from having any Suſpicion on that head.

On the contrary, *Luke Schræckius, on ſigured* Beech-wood, *Eph. N. C. Dec.* 3. *An.* 7, 8. *Obſ.* 118. follows *Reiſelius*'s Opinion; and being vers'd in *Malpighi*'s Anatomy of Plants, writes: “ No wonder, “ if Figures cut in a young Tree, by the Length of “ Time, and the Accretion of many Barks, appear at “ laſt about its Middle, when grown old.”

*John Chriſtopher Gottwald, on a crucified Man drawn by Nature in the Middle of a* Beech-trunk [*], *Eph. N. C. Dec.* 3. *An.* 9. *Obſ.* 158. accuſing Nature's ſimple Violence, or a Diſeaſe of the Tree, is corrected by the moſt celebrated *John James Scheuchzer*, in his *Itinera Alpina, Tom.* 3. *pag.* 414. and in his *Herbarium Diluvianum, p.* 46. *of a little Man in* Beech-wood, *Tab.* X. where he makes mention of other Inſtances.

*John Melch. Verdries* is of the ſame Sentiment, treating *of a Figure found in the Middle of a* Beech, *Eph. N. C. Cent.* 3 *&* 4. *Obſ.* 89.

There remains, to my Knowledge, *the Figure of a Chalice with a Sword perpendicularly erect, and on its Point ſuſtaining a Crown*, found in the Heart of a Piece of Wood at the *Hague*; which the Authors of the Collections of *Breſlaw* exhibit to us “ as a “ ſingular *Phænomenon*, worthy of being compared “ to *Aldrovandus*'s *Guaiacum-tree*, and ſigured “ Stones, if no Optic Fallacy, Error of Judgment,

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[*] This Wood is kept in the Library of the Council of *Dantzick*.

“ artificial Fiſſure of the Wood, or other ſuch Deceit, “ intervene.”

In fine, the Caſe is thus: Such as were wont to be frighted with Hobgoblins from their Infancy, hear the Ruſtling of Phantoms a great way off, and ſee them walk at Noon-day; while others, who have learned to inquire into the Cauſes of Things, are by thoſe accounted dull of Sight and Hearing.

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## XVII. *Part of a Letter from Sir* John Clark, *one of the Barons of His* MAJESTY'S *Exchequer in* Scotland, *and* F. R. S. *to* Rog. Gale, *Eſq*; Tr. R. S. Nov. 6. 1731.

—I Was lately in *Cumberland*, where I obſerved three Curioſities in *Whinfield-Park*, belonging to the Earl of *Thanet*. The firſt was a huge Oak, at leaſt ſixty Foot high, and four in Diameter, upon which the laſt great Thunder had made a very odd Impreſſion; for a Piece was cut out of the Tree about three Inches broad, and two Inches thick, in a ſtrait Line from Top to Bottom. The ſecond was, that in another Tree of the ſame Heighth, the Thunder had cut out a Piece of the ſame Breadth and Thickneſs, from Top to Bottom, in a ſpiral Line, making three Turns about the Tree, and entering into the Ground above ſix Foot deep. The third was the Horn of a large Deer found in the Heart of an Oak, which was diſcovered upon cutting down the Tree. It was found fixed in the Timber with large iron Cramps; it ſeems therefore, that it had at firſt been faſtened on the Outſide of the Tree, which in growing afterwards had incloſed the Horn. In the ſame Park I ſaw a Tree thirteen Feet of Diameter.

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## Remarks by the *Publiſher*.

THIS Horn of a Deer found in the Heart of an Oak, and that faſtened with Iron Cramps, is one of the moſt remarkable Inſtances of this kind, it being the largeſt extraneous Body we have any-where recorded to have been thus buried, as it were, in the Wood of a Tree. If *Joannes Meyerus*, and *Joannes Petrus Albrechtus*, (p. 233.) had ſeen this, they could not have imagined the Figures ſeen by them in Beech-trees to have been the Sport of Nature, but muſt have confeſſed them to have been the Sport of an idle Hand. To the ſame Cauſe are to be aſcribed thoſe Figures of *Crucifix*'s, *Virgin Mary*'s, &c. found in the Heart of Trees; as, for Example, the Figure of a *Crucifix*, which I myſelf ſaw at *Maſtricht*, in the Church of the *White Nuns* of the Order of St. *Auguſtin*, ſaid to be found in the Heart of a Walnut-tree upon its being ſplit with Lightning. And it being uſual in ſome Countries to nail ſmall Images of *our Saviour* on the Croſs, of *Virgin Mary*'s, &c. to Trees by the Road-ſide, in Foreſts and on Commons; it would be no greater a Miracle to find any of theſe buried in the Wood of the Tree, than it was to find the Deer's Horn ſo lodged.

Sir *Hans Sloane*, in his noble *Muſeum*, hath a Log of Wood brought by Mr. *Cunningham* from an Iſland in the *Eaſt-Indies*, which, upon being ſplit, exhibited theſe Words in *Portugueſe*, DA BOA ORA. i. e. Det [*Deus*] bonam Horam.

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between the *Two Temple-Gates* in *Fleetſtreet*;
and C. DAVIS, over-againſt *Gray's-Inn Gate* in
*Holbourn*; PRINTERS to the ROYAL SOCIETY. M.DCC.XLII.

TAB. I.

Fig. 1.

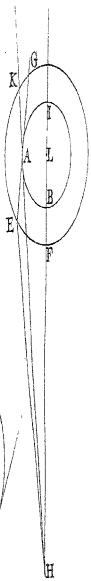


Fig. 2.

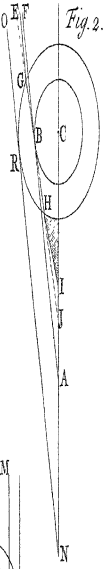


Fig. 3.

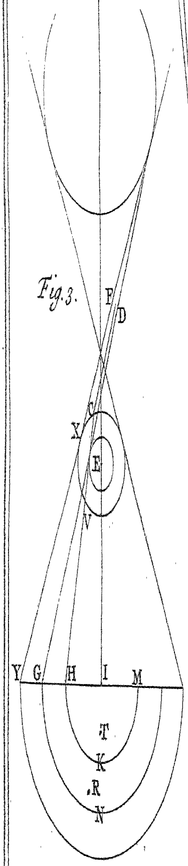
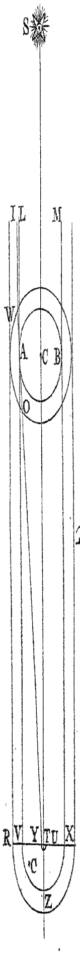


Fig. 4.



TAB. II.

Fig. 1.

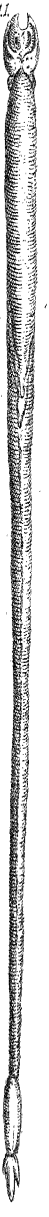


Fig. 2.

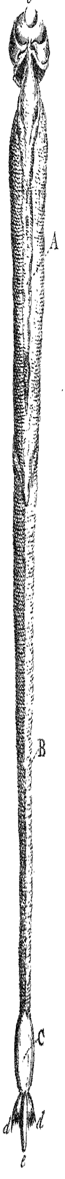


Fig. 3.

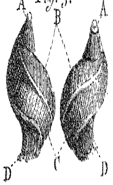
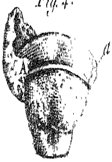


Fig. 4.



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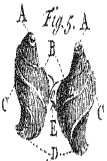

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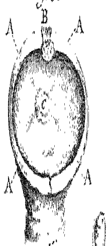

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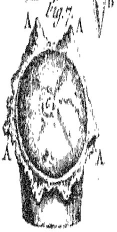
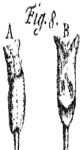


Fig. 8.



J. Mynde Sculp.

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# I. *A Letter from his Excellency* Nicolas-Michael d'Aragona, *Prince of* Caſſano, *and* F. R. S. *to the* Preſident *of the* ROYAL SOCIETY, *containing an Account of the Eruption of* Veſuvius *in* May 1737. *Tranſlated from the* Italian *by T. S.* M. D. *F. R. S.*

*SIR,*

AS your extraordinary Talents, and excellent Taſte, in a true Examination of Natural Effects, and in Diſcoveries relating to Experimental Philoſophy, are ſo well known, that you have, with Juſtice, been elected into the moſt celebrated Academies of *Europe*, and to the Preſidentſhip of the ROYAL SOCIETY of *London* in particular; I reſolved, with good Reaſon, to offer you a ſhort Account of the laſt great, dreadful and pernicious Eruption of our *Veſuvius*; to the End that, if you are pleaſed to inveſtigate the Cauſes thereof, the Republic of Letters might reap ſome general Advantage, as it does daily, by means of its Members of the firſt Rank in Merit.

Mount *Veſuvius* is generally eſteem'd about ſeven Miles diſtant from *Naples*. It riſes in the Middle of a large Plain, which ſurrounds it on every Side. It is better than four Miles from the Sea; and the Foot of the Mountain is ſeen to begin from the Sea-Coaſt, which growing gradually higher, reaches the firſt Plain, to which one can eaſily ride on Horſeback. The Figure of the Plain is almoſt circular, being about five Miles in Diameter, and half a Mile perpendicular Heighth above the Level of the Sea. This is the Baſis of the Mountain, out of which ariſes another, called by the People of the Country *Monte-vecchio*, whoſe perpendicular Heighth is about four hundred Paces, and its Top little leſs than two Miles in Circumference, of an irregular Figure. The ſaid Top, before the Year 1631. was of the Form of a Baſon, but all ſurrounded with aged Oaks, and vaſtly large Cheſtnut-trees, whoſe Fruit afforded Food ſufficient for a Number of Cattle that fed thereon. In the Bottom a Cavern was obſerved, into which People deſcended above two hundred Paces, by difficult and interrupted Paths; and this Opening was looked upon as the antient Mouth, which for a long Space of Time had conſtantly caſt up great Quantities of bituminous Matter, and had at the ſame time burnt a conſiderable Part of the neighbouring Country, cultivated by the Inhabitants round the Hill.

Concerning the Eruptions that have happened heretofore, they are very numerous, as well antient as modern.

Of the firſt, ſeveral are taken Notice of by *Beroſus Chaldæus*, *Polybius*, *Strabo* in the time of *Auguſtus*, *Diodorus*, and *Vitruvius*; and in *Trajan*'s Reign the Name of the Mountain became more famous by the Death of *Pliny*. From that time forward, 'tis not doubted, that the Eruptions were leſs frequent down to the Year 1139; when, after a conſiderable Eruption, it began to take Reſt, and continued quiet ſomewhat leſs than five Centuries; ſo that the horrid Remembrance of the paſt Ruins was pretty well obliterated out of the Minds of the neighbouring Inhabitants; who, vainly flattering themſelves with Hopes, that the inflammable Matter was ſpent, planted the whole Diſtrict round the Mountain, which, by its Fertility, became the Delight of theſe Parts. But, in Proceſs of Time, they found themſelves deceived and fruſtrated in their Expectations: For in the Year 1631. during ſix Months Space, continual Rumblings were heard, and Shocks of Earthquakes felt: And afterwards, in the Month of *December*, a dreadful fiery Eruption happen'd, which firſt blew up Part of the Mountain into the Air, in a terrible Manner, and then vomited out Water, Aſhes, Stones and Fire; inundating almoſt the whole Country around, to the Sea, and for above ſeven Miles in Breadth, with the irreparable Loſs of more than four thouſand People. After which the Mountain became ſilent, and remain'd conſiderably diminiſh'd in its Heighth, from what it had been before.

It continued quiet for twenty-nine Years; but having rekindled in 1660. its Fire fill'd the whole Capacity of the immenſe Hollow, which remain'd ſince the Year 1631; whence, after ſeveral leſſer Eruptions, a new Mountain appear'd in 1685.

In 1707. not only the Inhabitants of the Neighbourhood, but alſo the whole City of *Naples*, were put into great Terror, and not without Reaſon, by the Apprehenſions of a Renewal of the diſmal Tragedy of 1631. upon account of the frequent Noiſe and Shocks, the Fire ſeen on the Top of the Mountain, with a vaſt Quantity of Aſhes, which iſſuing out with Impetuoſity, were diſperſed all over our Hemiſphere, and darken'd the Light of the Sun for one

whole

whole Day's Space. Theſe were all manifeſt Signs of the impending Deſolation: and yet (whether by a Miracle of our particular Protector St. *Januarius*, as ſome were of Opinion, or by natural Cauſes) this dreadful Day, which had portended ſo much Miſchief, was beyond Expectation, and to our great Aſtoniſhment, follow'd by another as pleaſant as could be deſired: for the Air was quite ſerene, and clear of the Aſhes; and on the Mountain there was no other Appearance but that of a little Smoke.

In the Year 1724. the Quantity of Aſhes and Stones, thrown from the Top of the Mountain, were ſo heaped from the Bottom up to the Edge of the old Mountain, that the whole Space from the old Hill to the new, appeared but one continued Mountain.

In 1730. there was another Eruption of *Veſuvius*, which, though very inconſiderable in reſpect of the laſt, yet was the Occaſion of much Fear.

This preſent Year 1737, to the Month of *May*, the Mountain was never quiet: Sometimes emitting great Quantities of Smoak, at other times red-hot Stones; which, for want of a ſufficient impelling Force, fell on the ſame Mountain. But in order to a clear Idea of all the Circumſtances preſaging the impending Eruption, 'tis requiſite to know, that in the Beginning of *May*, a Smoak only was ſeen to iſſue from the open Mouth at the Top; and from the 16th to the 19th, ſubterraneous rumbling Noiſes were heard.

On the 19th, Fire was ſeen to burſt out in thick black Clouds; and the ſame Day there were ſeveral loud Reports, returning quicker towards the Evening:

ing: And ſtill more on *Sunday* Night, when there conſtantly appear'd a very great Smoak mix'd with Aſhes and Stones; and the Neighbourhood felt ſome Shocks, like thoſe of a weak Earthquake.

On *Monday* the 20th, at the 13th Hour, the Mountain made ſo loud an Exploſion, that the Shock was ſtrongly felt not only in the Neighbourhood, but alſo in the Cities twelve Miles round. Black Smoak, intermixt with Aſhes, was ſeen ſuddenly to riſe in vaſt curling Globes; which ſpread wider, as it moved farther from the Baſon. The Exploſions continued very loud and frequent all this Day, ſhooting up very large Stones through the thick Smoak and Aſhes, about a Mile high, to the Horror of the Beholders, and Danger of all the neighbouring Buildings.

At the 24th Hour of the ſame *Monday* 20th of *May*, amidſt the Noiſe, and dreadful Shocks, the Mountain burſt on the firſt Plain, a Mile diſtant obliquely from the Summit, and there iſſued from the new Opening a vaſt large Torrent of Fire; whence, by the Quantity of Fire inceſſantly thrown up into the Air, at a Diſtance all the South Side of the Mountain ſeem'd in a Flame. The liquid Torrent flow'd out of the new Vent, rolling along the Plain underneath, which is above a Mile long, and near four Miles broad; and in its Way it ſpread very ſpeedily near a Mile wide; and by the fourth Hour of the Night, it reached the End of the Plain, and to the Foot of the low Hills ſituate to the South. But as theſe Hills are rugged with Rocks, the greateſt Part of the Torrent ran down the Declivities between theſe Rocks, and into two Valleys; falling ſucceſſively into the other Plain, which forms the Baſis of the Mountain; and after uniting there, it divided into four leſſer Torrents, one of which ſtopp'd in the Middle of the Road, a Mile and half diſtant from the *Torre del Greco*. The ſecond flow'd into a large Valley. The third ended under the *Torre del Greco*, near the Sea; and the fourth at a ſmall Diſtance from the new Mouth.

The Torrent which flowed into the Valley, ran as far as between the Church of the *Carmelites* and that of *the Souls of Purgatory*, by the 8th Hour on *Tueſday*. The Matter of the Torrent ran like melted Lead: In eight Hours it made four Miles; and conſequently, it flowed half a Mile in an Hour: A new and remarkable Circumſtance of this Eruption, ſeeing *Bulifone* thought it very ſtrange, that in the Eruption of 1698. the Torrent had advanced ſixty Paces in an Hour; whence he infers, that ſuch great Swiftneſs proceeded from a greater Degree of Liquation of the Matter. The Trees, which the Torrent light on in its way, upon the firſt Touch took Fire, and fell under the Weight of the Matter.

The Torrent which ran behind the Convent of the *Carmelites*, after ſetting the little Door of the Church on Fire, entered not only therein, but alſo through the Windows of the Veſtry, and into two other Chambers. In the Refectory, it burnt the Windows; and, what is ſurpriſing, the Glaſs Veſſels, that ſtood on the Tables, were melted into a Paſte by the violent Heat of the Fire. Sixteen Days afterwards, the Matter continued hot, and was very hard, but it was broke by repeated Blows.

A Piece of Glaſs faſten'd on the Top of a Pole (and thruſt into this Matter) was in four Minutes reduced to a Paſte. Under the Maſs of the Torrent were heard frequent Reports, which made the Church ſhake, as if by an Earthquake. Along the whole Surface of the Torrent, there appear'd ſmall Fiſſures, out of which iſſued Smoak, that ſtunk of Brimſtone mix'd with Sea-water; yet theſe Exhalations are not poiſonous, but rather a Remedy for ſome Diſeaſes. The Stones round about theſe Fiſſures were obſerved to be covered with ſublimed Salts, the Nature of which I ſhall explain hereafter.

Iron, thruſt into theſe Fiſſures, was taken out moiſt; but upon thruſting in Paper, it was not moiſten'd, but rather ſomewhat harden'd.

At the ſame time when the new Mouth open'd, that on the Summit of the Mountain vomited a vaſt Quantity of burning Matter, which, dividing into Torrents, and ſmall Streams, ran partly towards the *Salvadore*, and partly towards *Ottajano*; and at the ſame time that this Matter iſſued out, red-hot Stones were ſeen to be caſt out of the Mouth, in the midſt of black Smoak, frequent Flaſhes of Lightning and Thunder, all produced by the ſame Matter.

Theſe impetuous Expulſions of Fire continued till *Tueſday*, when the Eruption of the melted Matter, the Flaſhes, and thundering Noiſe, ceaſed; but a ſtrong South-weſt Wind ariſing, the Aſhes were carried in great Quantities to the utmoſt Boundaries of the Kingdom; in ſome Places very fine, in others as coarſe as *Iſchian* Sand: And in the Neighbourhood they not only felt this plentiful Shower of Aſhes, but likewiſe Pieces of Pumice-ſtones, and other large Stones.

*Tueſday* Night the Fury of the Mountain began to abate, ſo that on *Sunday* there was ſcarce any Flame ſeen to break out of the upper Mouth; and on *Monday* but little Smoak and Aſhes. This Day it began to rain plentifully, which continued to *Tueſday*, and afterwards for many Days: A Circumſtance which has conſtantly happen'd after the Eruptions of Times paſt.

The Damages done in the Neighbourhood by this Eruption of Fire and Aſhes, are incredible. At *Ottajano*, ſituate between four and a half and five Miles from *Veſuvius*, the Aſhes on the Ground were four Palms high. All the Trees were burnt, (or blaſted) the People terribly affrighted, and many Houſes cruſhed by the Weight of the Aſhes and Stones that fell.

After the Deſcription of this fiery Eruption, the Academy of Sciences [at *Naples*] thought proper to make an accurate Analyſis of the Matter, and of the Salts, that were collected in great Plenty near the above-mentioned Fiſſures; and, towards the Diſcovery of the Truth, they effectually made the following Experiments:

## EXPERIMENT I.

Some of the Stones of *Veſuvius* being pounded ſmall, and the Loadſtone applied to the Powder, ſome few Particles were attracted by it; and the ſame Powder, put into *Aqua-fortis*, cauſed a ſenſible Effervеſcence; whence it certainly contains no ſmall Quantity of Iron: Which was alſo found upon Trial in another Eruption by *Tomaſo Cornelio.* But for the greater Elucidation of Truth, one of theſe Stones being applied to the Magnetic Needle, it turned to the Stone; and then carrying it round to the oppoſite End of the Needle, it immediately turned from it, in the ſame manner as if Iron was applied near the Compaſs.

### EXPERIMENT II.

The Stones are not all of the ſame Denſity or Colour; but various, and of different Ponderoſity. Some are compoſed of real Talc, others full of Marcaſites: Some are almoſt all ſulphureous, others nitroſe; ſome of a grey Colour, others red.

### EXPERIMENT III.

The Matter of the Current is ſpongy at Top, but very denſe towards the Bottom; which is a Proof of the Fuſibility thereof; whereby the heavier Bodies ſubſided, and the lighter remained at Top.

### EXPERIMENT IV.

After growing hard, it retained part of the Heat above a Month, though unequally: For in the inward Parts, where the Air had not free Acceſs, and the Matter was more compact, the Heat was much ſtronger than towards the Surface.

### EXPERIMENT V.

Twenty Days after the Eruption, in divers Parts of the Mountain, from the Bottom to the Top, there were ſeen to ariſe many pernicious Damps, [*Mofete*] eſpecially from the Cavities, and the Fiſſures of former Torrents; as alſo on the Plain: But none were obſerved in the Matter of this laſt Eruption. They iſſued out of the Fiſſures under the Appearance of a cold Wind, and roſe about three Palms high; then they moved along the Surface of the Ground, and, after a Progreſs of ſome Paces, diſappeared. Animals, which happened to graze where theſe paſſed, were all killed thereby; and likewiſe a *Tereſian* Frier, who inadvertently breathed the Vapour of one of theſe Damps.

## EXPERIMENT VI.

Having placed the Barometer in the Vapour, it underwent no Change, but the Thermometer fell ſomewhat more or leſs. A lighted Torch, thruſt into them at two Palms from the Ground, was ſoon extinguiſhed by the Action of the Damp.

## EXPERIMENT VII.

Theſe Damps grew gradually weaker in their pernicious Effects for above three Months, even to the ſubſequent Autumn; as has been generally found in other former Eruptions, or when they happened to iſſue out of their Vents.

## EXPERIMENT VIII.

Concerning the Salts which are generated in Abundance in *Veſuvius*, I have, by Order of the Academy, examined them by accurate Experiments. My Intention was to know, if beſides Salt Ammoniac, there were alſo Sea-Salt, Vitriol, Nitre, or any other Salt. I thought there was no better way of proceeding in this Inquiry, than by Cryſtallization; becauſe it is univerſally allowed, that Salts in Cryſtallizing conſtantly retain one certain and determinate Figure; Sea-Salt concreting into Cubes, Vitriolic Salt into Rhomboidal Parallelepipeds, Alom into Octædrons, and Nitre into Rectangular Priſms on Hexagonal Baſes. I imagined, that if the Salt of *Veſuvius* happened to contain any Particles of the Salts above-mentioned, it would diſcover them after Cryſtallization. This way of Reaſoning was confirm'd by Experiment: For the *Veſuvian* Salt, in Cryſtallizing, left on the Sides of the Veſſels ſmall Parcels of cryſtallized Salts, which, obſerved through a Microſcope, reſembled a Tree with its Branches, on the Ends of which there appeared ſeveral Pyramids of an irregular Figure, but very ſharp-pointed; and between the Branches there were interſperſed in ſome Places a Group of Priſms, in others ſome ſmall Cubes: Whence I inferred, that the aforeſaid Salt was Ammoniacal, and indeed a genuine and efficacious Salt Ammoniac, with inſenſible Portions of Nitre and Sea-Salt. Which coincides with the Sentiments of the Royal Academy of *Paris* in 1705; with thoſe of *Thomas Cornelius* in his *Progymnaſma de Senſibus*; of *Dominicus Gulielmini* in his Treatiſe *de Salibus*; of Dr. *Boerhaave* in his Chemiſtry, and many other Writers.

## EXPERIMENT IX.

In order to be convinced whether this Salt was really Ammoniacal, and of the Nature of neutral Salts, I mixed it with Spirit of Vitriol, and Spirit

of

of Salt, without producing the leaſt Fermentation. I afterwards put ſome of it into Oil of Tartar *per Deliquium*, and could not perceive any Ebullition; wherefore it is to be ranked among the neutral Salts.

### EXPERIMENT X.

Thrown upon red Coals, it did not crepitate like Sea-Salt, but it boiled and ſwelled, and after evaporating it dried up.

### EXPERIMENT XI.

It is of a very pungent Taſte, ſtrongly pricking the Tongue, and of a bituminous Smell of Brimſtone, which occaſions a violent Head-ach by its volatile Texture.

### EXPERIMENT XII.

The Salts taken from different Stones are not all of the ſame Weight or Colour: For ſome are yellow and unctuous, as if rubbed all round with *Petrolæum*: Others are very white, others blackiſh, and others of other Colours, according to the Stones they adhered to.

### EXPERIMENT XIII.

I have likewiſe found by Experience, that the Salt Ammoniac of *Veſuvius* is much more efficacious than any other Salt known at this Day, in cooling Liquors. Upon diſſolving ſome of it in Water, it makes the Water ſo cold, that the Sides of the Veſſel which contains it, can hardly be touched without Uneaſineſs, through the exceſſive Cold.

## EXPERIMENT XIV.

Monſ. *Geoffroy*, a celebrated Member of the Academy of Sciences, looks on it as a ſingular Power of common Salt Ammoniac, that being mixed with a certain Quantity of Water, it rendered the Water ſo cold, that it made the Spirit of his Thermometer, eighteen Inches high, fall thirty-three Lines. But I have ſhewn to ſeveral Perſons, that the *Veſuvian* Salt makes the Liquor of a Thermometer, like his, fall four Inches and an half; which is equal to fifty-four Lines. Wherefore the Efficacy of this Salt, in cauſing the Fall of the Liquor, exceeds the Efficacy of common Salt Ammoniac by twenty-one Lines.

## EXPERIMENT XV.

If round a Veſſel full of Water cooled with Snow, there be put ſome of the Salt of *Veſuvius*, the Water freezes and grows hard in a very little time.

## EXPERIMENT XVI.

If you put a good Quantity of the Salt of *Veſuvius* into Snow ſet round a [Glaſs] Veſſel full of Water, and then ſtir the Veſſel, the Water contained therein becomes unfit to drink; having acquired a very diſagreeable acrid ſulphureous Taſte; a manifeſt Sign, that the Salt is divided into ſmall Particles, which paſſing through the inſenſible Pores of the Glaſs, enter into and mix with the Water.

## EXPERIMENT XVII.

Of all kinds of Salts, this diſſolves in the greateſt Quantity in Water; and perhaps the greater or leſſer

Diſſolubility of a Salt in Water, will be [found] proportional to its greater or leſſer Effect in cooling Water.

### EXPERIMENT XVIII.

Being put into Brandy, or Oil, beſides that very little of it is diſſolved, it occaſions no Deſcent of the Liquor in the Thermometer.

### EXPERIMENT XIX.

Being mixed with Blood lately drawn from the Vein of a Man, but coagulated after ſettling, the Blood was thereby diſſolved, and continued in that State for the Space of twenty-four Hours.

### EXPERIMENT XX.

A Solution [of this Salt] being injected into the Vein of a Dog, firſt occaſioned Tremors, then univerſal Convulſions, and laſtly Death: And four Hours afterwards, having opened the Dog, the Blood, which ſhould have been coagulated, was found fluid, both in the Trunks of the Veins, and at the Ends of the Arteries.

### EXPERIMENT XXI.

It has all the Properties of Salt Ammoniac to that Degree, that upon ſubſtituting this *Veſuvian* Salt, inſtead of common Salt Ammoniac, the ſtrongeſt ſort of *Aqua Regia* may be had for diſſolving Gold: Which Experiment was made with Succeſs by Monſ. *Lemery*, in the Academy of *France*.

## EXPERIMENT XXII.

If a Lump of the Mineral Matter be reduced to a fine Powder, and attentively viewed through a Microſcope, it appears very like the Sand of *Iſchia*, and is very proper for Writing-Sand: Whence I conjecture, that that Sand is nothing elſe, but the [ſame] Matter for a long time comminuted by the Action of the Sea.

## EXPERIMENT XXIII.

In ſome of the Stones there appear ſome few Veins of Gold, in others of Silver, but inſenſible; and in others, which are very heavy, there is ſome Antimony.

## EXPERIMENT XXIV.

A great Diſpute aroſe in the Academy on the Riſe of the [*Moſete*] Damps; for what Reaſon theſe ſhould be ſeen only in the old *Strata* of the mineral Subſtances, and not in the new, where by the Action of the Fire they ought to iſſue: Which *Phænomenon*, if I am not miſtaken, may be accounted for in this manner: As the cooling of the burning Matter began at the Surface, we may think, that the more ſubtle heterogeneous Particles, upon the cloſing of the Pores at the Surface, remained in Quantities buried in the lower Parts of the Matter; which, in Proceſs of Time, becoming acutangular and of deleterious Figures, yet cannot offend while impriſoned: But in new Eruptions, wherein the Shocks given to the Matter produce many Fiſſures, the Damps, meeting with leſs Reſiſtance there, iſſue forth: As when the Air is a long time pent up in ſome Hollow, upon giving it Vent, it generally comes out in a pernicious Vapour.

### EXPERIMENT XXV.

It was obſerved, that the greateſt Shocks happened to ſuch things as ſtood expoſed to the *Volcano*; but that thoſe things which were not thus expoſed to it, received but faint Shocks: A manifeſt Sign, that the Vibration of the Air had a great Share in the Shocks of the Earth: Which Circumſtance is taken Notice of by *Borelli* with reſpect to Mount *Ætna*.

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## II. *An Abſtract of a Letter from an* Engliſh *Gentleman at* Naples *to his Friend in* London, *containing an Account of the Eruption of Mount* Veſuvius, May 18. *and the following Days,* 1737. *N. S.*

*SIR,* Dated *Naples*, *Aug.* 30. 1737. *N. S.*

YOU have laid a very hard Task upon me, to ſend you an Account of the late Eruption. * * I was lodged for ſome time at *Chaja*, and afterwards at *Fontina Medina*, in the Face of this ſurpriſing Neighbour [Mount *Veſuvius*], which from thence doth not appear to be above two or three Miles diſtant.

It gave us Strangers conſtant Entertainment, by ſhewing us what it could do, as well as great Satiſfaction to the People of *Naples*, who, whilſt it continues burning more or leſs without ceaſing, are under no Apprehenſion (and I believe with good Reaſon) of an Earthquake: But we little thought of being invited to a Sight, *quod nunquam vidimus, & nunquam videbimus*; for by all the Accounts of the Living, there has not been any Eruption in their Remembrance near ſo violent, nor ſo furious; and Authors mention none to this Degree later than above One hundred Years ago. On *Friday*, *May* 17. 1737. *N. St.* I obſerved, as far as I could ſee round, that the Mountain was covered with white Aſhes a great Way down, as it hath been with Snow in the Winter, which I could not find any body here or at *Barra* near *Portiche*, take any Notice of; though I ſhould be apt to think for the future, that it might be a Fore-runner; for I had never ſeen any thing like it. *Pliny* obſerves in theſe Words, *Præceſſerat per multos dies terræmotus minus formidoloſus, qui Campaniæ non ſolum caſtella, verum etiam oppida vexare ſolitus.* (Plin. *Lib.* 6. *Ep.* 20.). Other Authors ſay the contrary; though it may very likely be ſo, round and near the Foot of the Mountain; but this time I have not found any body ſenſible of it here; but it is certainly true, that our Windows and Doors ſhook all the time of the Violence of the Eruption, which I take to be from the very great Concuſſion of the Air upon the violent Exploſions: A Door which had a Latch, to my great Surprize, opened often of itſelf. I cannot conceive a tremulous Motion of the Earth from the Mountain hither, unleſs it were thoroughly cavernous from thence, which the People here deny, and particularly the Author *Paragallo*.

On *Saturday* Night, (*May* 18.) this great *Phænomenon* began, and increaſed ſo much on *Sunday*, that it brought half the People out to gaze at it, with great Variety (no doubt) of Paſſions and Ratiocinations. There were certainly, amongſt ſome, great Apprehenſions, by their being imployed in Proceſſions, viſiting their Churches, and expoſing their Images of the Virgin *Mary*; but I looked upon them as very ungrateful to their great Patron [St. *Januarius*], in having any Dread, when they even boaſt, that he has never failed delivering them from their greateſt Diſtreſſes; but by the terrible Havock I have obſerved in their Country, as well as what has been made by this laſt Eruption, I find he hath always left them in the Lurch: However, as I had not loſt a Grain of the Faith I ever had in that Saint,

I very boldly ſet out on *Monday* about two Hours before Sun-ſet. It was a melancholy Sight, to ſee the Road full of Numbers of poor Wretches, flying as from *Sodom*. I ſtopped on the Way, to obſerve the vaſt Clouds of Smoak, which was thrown up in a prodigious Column, to an Height not to be gueſſed at, which, by its gentle Waving and Undulation, was a moſt beautiful Sight; and when it had mounted ſo high, that it had loſt the Force of the Protruſion, it was carried by the Wind a vaſt Way; but not too far for one to obſerve how its Rolls began to break, and, being diſperſed and expanded, covered the Country underneath with Aſhes and Darkneſs. There were many great Flaſhes of Lightning darted through this Pillar of Smoak, and frequent Diſcharges as of Cannon or Bombs, which were followed by falling Stars, ſuch as we ſee from well-made Rockets. We turned off out of *Portiche*, to gain the North-ſide of the Mountain, as far as we could, in Chaiſes, till we were forced to get upon Aſſes or Mules.

It was now growing dark, and the Fire began to be viſible, which it was not in the Day-time, the Sun bearing no Rival. The prodigious *Bouillon* of Fire, and the extreme Force it was expelled with, as well as the vaſt Height it was carried up to, are not to be deſcribed or gueſſed at. If I ſhould imagine an hundred *Stentors* or *Polyphemus*'s, with as many of *Phalaris*'s Bulls roaring all together, they could not bellow more terribly. But to have a truer Idea of this Scene, you muſt look into *Burnet*'s moſt beautiful Painting of the general Conflagration. As we looked round this Northern Side, the whole Country appeared as if over-run by *Samſon*'s Foxes.

In a little time, by the Light of the Mountain, (though that was much obſcured by the Clouds and Pillar of Smoak) and the Help of our Torches, we ſcrambled over very rough Roads, till we got within about a quarter of a Mile of the great *Lava* or Current: But then I ordered an Halt; for indeed the Scene on all Sides became ſo ſtupendous and terrible, that I thought I ſhould make a very fooliſh Figure, if any Misfortune ſhould happen to us.

We returned to *Portiche*, where we ſupped, and got home, much fatigued, by Two in the Morning. The Fury of this Eruption was at its Height this Night, as to burning; but the next Day (*Tueſday*) the Columns and *Bouillons* of Smoak were as great, and thrown out with as much Violence, which, as the Wind ſat, carried its Deſtruction, not of the large maſſy metallic Bodies, but of infinite Quantities of Aſhes and Cinders, all that Day, and Part of the Night.

Through

Through the Columns of Smoak was a continued Lightning, the moſt beautiful Sight imaginable.

The following Day (*Wedneſday*) we ſet out again to view the Weſt-ſide of the Mountain at *Torre del Grejo*, Eight Miles from hence; where we heard, that the great *Lava* had ſtopped at the Church of the *Carmelites*, but not without carrying Part of it away: Yet the People were ſuperſtitious enough to think this Stop miraculous; though it made a great Breach on one Side, broke down and quite demoliſhed their Sacriſty, beſides cracking the Roof. This *Lava* had from the Declivity taken the Water-courſe, which was the Preſervation of the Country from being drowned (and the People had beſt look to themſelves, unleſs they make another). This Hollow, which was for ſome Miles between Thirty and Forty Feet deep, and as many wide, was not only filled up, but the Matter roſe as many Feet above the Surface of the Land about it: We walked to view it on one Side, but the Heat was ſo intenſe, and the ſulphureous Stench ſo ſuffocating, that we were obliged to keep at a good Diſtance; and I was well informed by ſeveral, that it continued very hot a Month or five Weeks after; ſo long in cooling is that great Quantity of bituminous and metallic Matter, with which this *Vomes* is loaded.

As the Fury of the Expulſion and Exploſion was much abated on *Tueſday* Morning, the Stop here was about Four o'Clock that Day in the Afternoon; which might be the more eaſily conceived, when no more of this vaſt metallic Matter was diſcharged, and the Motion of all the reſt was relented, for want of more Protruſion, and the Bitumen growing a little cooler. As this Stop was made at the Church, Part of the *Lava* took a Turn into the great large Road to *Salerno,* to a great Height; which Part is choaked up for ever, the Expence being immenſe to remove it. *N. B. Giulio Ceſare Reputio,* one of the Authors who deſcribes the Eruption in 1631. ſays, one of the maſſy metallic Bodies was in his Time weighed, and the Weight amounted to Five hundred *Cantaras,* a *Cantara* being nearly Two hundred Weight. They have ſince made the Road paſſable, by laying Earth upon the *Lava,* and ſo have added to the Hills of their Country. There are ſome who pretend to ſay, that the Matter diſcharged this time in the different Currents or *Lava*'s round about, would make a Mountain as big as their Sire. The *Carmelites* here ſoon fled, and were not come back ten Days afterwards, when we returned that Way, to viſit the South-eaſt Side, to view the great Devaſtation which was made about *Ottajano,* eighteen Miles from hence; for though the great Diſcharge of the metallic Body ceaſed on *Tueſday,* (*N. B.* they did not let their Patron budge till the next Morning) a vaſt Deſtruction of the Country followed for a long time after; for as the Force of the Exploſion was very great, it continued to throw out vaſt Showers of Cinders and Aſhes. The Lands indeed, where the *Lava's* fall, are annihilated to the Owners; but the other Materials deſtroy all the Fruit and Produce of the Earth where they fall, which doth not recover for a long time; and in this unhappy Diſtrict, his Majeſty hath, with great Goodneſs, taken off all Taxes for Ten Years.

As we turned on the Left from *Torre del Grejo* towards *Ottajano*, we paſſed all the Way through their *Maſſerias* [Farms]; and the Mountain, having the Weather-gage of us for three or four Miles, rained Aſhes plentifully upon us, and we loſt our Smell of every thing but Brimſtone. All the Trees, Vines; and Hedges, bent under the Weight of theſe Aſhes, ſeveral Arms, and even Bodies of Trees, were broken with the Weight; ſo that in ſome narrow Roads we had Difficulty to paſs. Within a Mile or two of the Prince of *Ottajano*'s Palace (a very honeſt worthy Gentleman, who has ſuffered a Loſs of above 100,000 Ducats, or 50,000 *l.* ſome ſay more) one can ſcarce frame to one's ſelf a Sight of greater Deſolation; Ten ſucceſſive Northern Winters could not have left it in a worſe Condition: Not a Leaf on a Tree, Vine, or Hedge, to be ſeen all the Way we went, and ſome Miles farther, as we were informed: Here, and at the Town, they had a new Earth, about two Feet deep, ſome ſaid more, by the Account of the miſerable Inhabitants, who were a diſmal Spectacle, though they had recovered their Fright, and ſeemed to be got into a new Heaven. The Storm fell ſo thick and heavy for that time, that they almoſt all fled, and many Houſes were beaten down. In one Convent, two or three Nuns were buried in the Ruins. At *Somma*, on the North-eaſt Side, it has made great Havock; a Monaſtery of Nuns was deſtroyed. After a long Day's Work, we returned at Six o'Clock.

Thus, Sir, I have given you our Journal, and an Account of what I obſerved of this *Monſtrum horrendum ingens!* I fear you expect ſome Reflections upon the *Phænomena*: A few Thoughts, though very common ones, I offer for your Correction.

The Earth of this Country is, no doubt, greatly compounded of Sulphur and Nitre, from whence Dr. *Burnet* hath fixed it for the Beginning of the general Conflagration; though he has, out of a particular Spite to the People of *Rome*, laid the Commencement of it there. The great Quantities of Sulphur and Nitre are, to be ſure, the Operators of theſe great Exploſions, Lightnings, Bombs, Bellowings, and Expulſions of all this Matter; and Nature can certainly make much ſtronger and more elaſtic Gunpowder, than Mankind; elſe thoſe great maſſy Bodies of Metals could not be thrown up with that vaſt Force, to that great Height. The Bodies are compounded of various Metals, and, as it were, incorporated with the Bitumen: They pretend to find ſome Silver, but I queſtion whether the Gains will pay the Coſts. They have ſpoken of the *Lava*'s, as if their Motion was quick; but I obſerved otherwiſe, that it is ſlow, and the Progreſſion rather like a vermicular one: And beſides truſting to my Sight, I am rather apt to think it muſt be ſo, becauſe, though in a great Declivity, theſe great Maſſes muſt be much retarded in their Motion, by their large unequal Points or Angles; beſides, the Glewyneſs of the Bitumen as it cooled, would very much impede a quick Motion; which Bitumen is that Matter that flames, ſmokes, and is ſo very ſuffocating.

By ſome of the Antients, theſe burning Mountains have been looked upon as Divinities, and that they lived there: To confirm which, there was a Marble found at *Capua* (as *Paragallo* affirms) with this Inſcription,

ſcription, *Jovi Veſuvio ſacrum D. D.* The *Greeks* made uſe of them in their Mythology, by clapping the Rebel Giants under them.

I muſt not conclude without ſaying ſomething of the *Mofete*, upon which much hath been written, particularly by *Leonardo de Capua*; but all might be reduced into a narrow Compaſs. I mention it now, becauſe it hath given great Terror to the Neighbourhood of this Mountain; Four or Five Perſons near *Torre del Grejo*, *Portiche*, and ſome other Place, having been killed by going into their Caves or Cellars: And it is particularly remarked to have been thus deſtructive all round the Hill, after the great Eruptions; upon which the great Agitation and Rarefaction of this inflammable Earth, compoſed of ſuch active Particles, even *Sal Ammoniac*, muſt ſend out vaſt and ſtrong *Effluvia*, (or what in ſuch cloſe Places may properly be termed Exſudations) pernicious, no doubt, when confined under Ground, and hindered from expanding and mixing with freſh Air: And, no doubt, all round the Mountain they abound; but the open Air is a Specific againſt their ill Effects; as we ſee it is an immediate Cure to the poor Dog at the *Grotto del Cane*, and not any particular Quality of the neighbouring Lake, which Throwing him into, I ſhould rather think, would kill him, till he had recovered his Reſpiration and Spirits. *Virgil, Æn.* VII. 84. mentions theſe Damps:

> ——— *Nemorum quæ maxima ſacro*
> *Fonte ſonat, ſævamque exhalat opaca mephitim.*

And to theſe Stenches *Perſius*, Satire III. l. 99. reſembles the Scent of a ſtinking Breath:

> *Gutture ſulphureas lente exhalante mephites.*

The following Authors have given very ample Accounts of the Eruption of Mount *Veſuvius*, on *Dec.* 16. 1631.

*Giulio Ceſare Braccini*; Dell' Incendio fattoſi nel *Veſuvio*, a 16 *Dec.* 1631. *Neapoli*, 1632. 4to.

Don *Juan* de *Quinones*; El Monte *Veſuvio*, *Madrid.* 1632. 4to.

*Julius Cæſar Recupitus*; de Incendio *Veſuviano* Nuncius, *Neapol.* 1632-3. 8vo.

*Joh. Bapt. Muſculus*; de Incendio *Veſuvii.* Neapol. 1633. 4to.

*Gaſpar Paragallo*; Ragionamento de' *Tremuoti.* Napoli, 1689. 4to.

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## III. *De Atmoſphæra* Lunari, *Diſſertatio Aſtronomica. Auctore D^{no}* Johanne Paulo Grandjean de Fouchy, *in ſuprema* Galliæ *Rationum Curia Senatore, & Reg. Scient. Acad.* Pariſ. *Socio.*

CELEBERRIMA eſt apud aſtronomiæ phyſicæ cultores de atmoſphæræ lunaris exiſtentia quæſtio. Multi, iique præſtantiſſimi viri, ipſam diverſis rationibus phyſicis ſolvendam, ſed vanis hucuſque conatibus, ſuſceperunt. Tot igitur & tantorum artificum irritis laboribus edoctus, aliam mihi viam tenendam ſtatui; ipſiuſque atmoſphæræ lunaris exiſtentiam ex meris obſervationibus inquirendam judicavi, non quidem ex ipſius atmoſphæræ corporis directo intuitu, quippe quod oculorum aciem facillime effugere poſſet, ſed ex phænomenis ipſius exiſtentiam neceſſario comitantibus, puta refractione radiorum ipſam, luna pleno

orbe

orbe fulgente, & in eclipſibus ſolis & fixarum a luna, pertranſeuntium; idque eo libentius, quod iſta radiorum refractio minime ab atmoſphæræ altitudine pendeat, quin e contra ipſi quodammodo reciprocetur; eadem enim atmoſphæræ virtute refringente ſuppoſita, eo major erit refractio, quo minor atmoſphæræ altitudo, radio luminis in ſuperficiem ipſius obliquius incidente.

Atmoſphæræ nomine intelligitur quædam materiæ diaphanæ congeries planetam involvens, quæ radios luminis ipſam pertranſeuntes a recta linea deflectere poteſt; ſive hæc materia in aëre noſtro ſimili, ſive ſeparatim ab ipſo exiſtat, quicquid ſit, hic de ſola materia refringente agitur, idque tantum in hujus operis decurſu probandum ſuſcipio, nullam circa lunam dari materiem, quæ radios luminis a recto tramite ſenſibiliter deflectere valeat. Hoc unum lectorem admonitum volo, me hic atmoſphæram ut fluidum homogeneum concipere ſuperficie ſphærica obductum, ejuſdemque ubique denſitatis, quæ decreſcentium denſitatum in reali atmoſphæra exiſtentium ſummæ æqualis ſit, omiſſa expreſſe partium ejus denſitatis differentia, quæ nullatenus noſtras demonſtrationes turbare poteſt. His itaque præmiſſis, ad rem ipſam properandum eſt: Et primo, quid variationis in diametris lunaribus ipſius, ſi exiſtat, atmoſphæra afferre poſſit, diſcutiendum.

TAB. I. Fig. 1. Si luna atmoſphæra cingitur, major obſervari debet ipſius diameter, quam in planeta nudo obſervaretur: ut autem ejus incrementi quantitas innoteſcat, ſit *AIB* ipſius lunæ corpus, *GEF* ipſius atmoſphæra, erit angulus *AHL* ipſiſſima lunæ diameter; & angulus *EHL* axe *LH*, & radio *AEH*, in *E* refracto comprehenſus, erit diameter lunæ obſervata.

ſervata. Angulus igitur *EHA* erit incrementum diametri lunæ ob ipſius atmoſphæram: Sed angulus *EHA* opponitur lateri *EA* trianguli *EHA*; & angulus *AEH* ſupplementum ad 180° refractionis horizontalis in atmoſphæra lunari opponitur lateri *AH* diſtantiæ lunæ a terra. Porro latus *EA* medietas eſt chordæ atmoſphæræ lunaris ipſius lunæ corpus in *A* tangentis. Sinus ergo incrementi *EAH* diametri lunæ ob ipſius atmoſphæram erit ad ſinum ſupplementi refractionis horizontalis *AEH*, ut medietas *AE* chordæ atmoſphæræ corpus Lunæ tangentis ad diſtantiam *AH* lunæ a terra.

Hinc ſequitur plane inſenſibile evadere illud diametri lunaris incrementum: Si enim ad 2″ $\frac{1}{2}$ aſſurgeret, ſuppoſita refractione horizontali 5′, id eſt, triginta ſaltem vicibus majori, quam ſupponi poteſt, ut ex infra dicendis patebit; ſemichorda *EA* 276 leucas Gallicas æquaret, atmoſphæræque terreſtris chordam ſimilem longe ſuperaret. Luna igitur atmoſphæra cingatur, necne, eadem ſemper obſervabitur ejus diameter; nulloque modo diametri lunaris obſervatio ſolvendæ quæſtioni par eſſe poteſt.

FIG. 2. Majorem decidendi dubii anſam præbent eclipſes ſolis a luna: Radii enim extremi conum umbræ lunaris terminantes, utpote qui corpus lunæ ſtringunt, & ejus atmoſphæram pertranſeunt, neceſſario verſus coni axem inflectentur; ideoque brevior & obtuſior conus evadet: ut autem illius variationis quantitas innoteſcat, notandum eſt radium *FA*, ſeu ipſi parallelum *EG*, qui, ſi nulla exiſteret atmoſphæra, umbræ lunaris *FAC* terminus eſſet, in ipſo atmoſphæræ ingreſſu *G*, & in egreſſu *H*, verſus axem *CA*, refringi: unde ſemiangulus coni umbræ lunaris

quan-

quantitate duplæ refractionis horizontalis in atmoſphæra lunari augebitur.

Hinc ſequitur, poſita atmoſphæra lunari, totalem ſolis eclipſin ſerius incipere, & citius abſolvi, quam illa ſublata; quin etiam in certis caſibus nullam fore eclipſin totalem; quam tamen diametri lunares & ſolares in eodem anomaliæ gradu obſervatæ poſcerent: in his enim caſibus conus umbræ lunaris ob atmoſphæram contrahitur, & ita contrahi poſſet, ut ne quidem diſcum telluris mucrone tangeret.

Fig. 3. Eodem plane modo minuerentur eclipſium partialium duratio & quantitas: eclipſis enim partialis initium obſervatur, cum penumbræ conus *GDI* habitationem obſervatoris ſupergreditur: ſuppoſita autem duplici in lunæ atmoſphæra refractione *FCE*, *EVH*, ſemiangulus coni penumbræ minuitur, ſemidiameterque baſis *GI* in *IH* contrahitur: ut igitur in loco dato initium eclipſeos obſervetur, centro *I* baſis penumbræ ſpatium æquale *GH* percurrendum erit: idem de emerſione dicendum. Partialis ergo eclipſis ſerius incipiet, & citius abſolvetur, ſuppoſita atmoſphæra lunari, quam luna nuda; quin etiam & minor obſervabitur: habitatio enim *T*, in penumbram quantitate *TN* immerſa, poſita atmoſphæra lunari, ipſam diſtantia tantum *TK* ingredietur. Fieri etiam poterit, ut nulla eo loci obſervetur eclipſis, ubi nulla ſuppoſita circa lunam atmoſphæra obſervaretur: diſco enim penumbræ imminuto, locus *R*, qui luna nuda in eam immergeretur, quantitate *RN* immunis ab ipſa pertranſibit. Qui autem in ſpatio *YH* radium inter directum *XY* atmoſphæram radentem, & radium refractum *EH* penumbram terminantem, comprehenſo

degens ſolem ab ipſo quidem lunæ corpore expertem, ſed tamen ab ejus atmoſphæra obſcuratum, videbunt; ideoque penumbra quædam pallida, quæ quidem ex prædemonſtratis, ubi de altitudine chordæ atmoſphæræ lunaris, & diametri ejus incremento, tertiam aut quartam ad minimum diametri lunaris partem lata obſervabitur, diſcum lunæ prægredi & ſubſequi debet: quin etiam hæc obſcuratio abſque omni eclipſi obſervari poterit, quotieſcumque circa terminos eclipticos luminarium ſynodus celebrabitur.

Hæc quidem præcipua phænomena in ſolaribus eclipſibus obſervari debent, ſi circa lunam exiſtat atmoſphæra: quid autem revera obſervetur, nunc videndum eſt.

Primo, Cum axis umbræ lunaris ad 55 ſemidiametros terreſtres, cum maximus, & $52\frac{1}{2}$, cum minimus eſt, extendatur, & præterea minima lunæ a terra diſtantia ſit 54 ſemidiametros terreſtres, ſi atmoſphæra lunaris refractionis horizontalis $8''$ capax eſſet, ſemiangulus coni umbroſi quantitate dupla, id eſt, $16''$, ex prædemonſtratis augebitur; ideoque $16' 41''$, cum apertiſſimus, & $16' 5''$, cum anguſtiſſimus, æquabit. Porro minimo ſemiangulo coni ſuppoſito æquali $16' 5''$; minor erit ejus axis minima lunæ a terra diſtantia 54 ſemidiametrorum terreſtrium, proindeque mucro umbræ lunaris nunquam ad terram uſque pertinget. Si igitur circa lunam exiſtat atmoſphæra, in qua refractio horizontalis ſit $8''$, nulla dabitur ſolis eclipſis totalis in terra. Nulla ergo exiſtit circa lunam atmoſphæra; aut, ſi exiſtat, refractionem horizontalem $8''$ minorem producit.

Quin & ſolares defectus totales cum duratione totalis obſcurationis obſervantur. In eclipſi, v. g. anni

1724. duratio obſcurationis totalis ad 2′ 16″ aſſurgebat. Luna tunc temporis motu horario 1′ 15″ percurrebat, umbraque ejus ſibi ſemper parallela in diſci terræ gradibus ſpatium 54 vicibus majus, id eſt, æquale 1° 7′ 30″, perambulabat: unde, ſi auferatur motus diurnus habitationis æqualis 20′, quippe qui durationem eclipſeos prolongare poteſt, diameter umbræ habebitur æqualis 47′ 30″, ſeu 45173 hexapedis, ſeu tandem 22 leucis Pariſienſibus. Unde inſtituto calculo eruitur axis coni umbræ lunaris uno ſaltem terræ diametro major diſtantia lunæ a terra, quæ tunc minima erat, luna circa perigæum verſante. Porro ex datis luminarium diametris in eodem anomaliæ gradu obſervatis axis coni umbræ lunaris elicitur 55 ſemidiametros, ad minimum, æquale: unde ſequitur maculam umbræ lunaris in diſco terræ, & axem coni, eoſdem præciſe reperiri, quos diſtantiæ lunæ & luminarium diametri obſervatæ poſtulare videntur. Nulla igitur circa lunam exiſtit atmoſphæra, aut nullam, ſi exiſtat, refractionem ſenſibilem producere valet. Sed ut nullus dubitationi locus relinquatur, eorum reddenda eſt ratio phænomenῶn, quæ in eclipſibus ſolaribus obſervata atmoſphæræ lunari excogitandæ locum dedere.

Primo quidem, exigua illa, quæ in defectibus totalibus obſervatur, lucula nullam in fluido lunam ambiente refractionem arguit: experimentis enim D. *Maraldy* a meipſo ſumma cura, & eodem ſucceſſu, repetitis, conſtat corporum nulla certe atmoſphæra veſtitorum, ſi ſoli exponantur, umbram circa coni axem clareſcere; idque eo magis, quo longius ab ipſo corpore receditur. Porro habitatio obſervatoris in defectu totali circa axem coni umbræ lunaris, & in ejus mucronis vicinia, verſatur. Mirum igitur eſſe non debet medium umbræ luce quadam maligna ſuffundi, quæ aliunde augeri poteſt radiis ab aëre illuminato umbram ambiente verſus umbræ medium reflexis.

Secundo, annulus lucidus lunam in defectibus totalibus ambiens atmoſphæræ lunaris exiſtentiam nullo mode probat, cum cuivis ſolem pila lignea, vel alicujus materiæ opacæ ſibi occultanti appareat. Unde atmoſphæræ ſolari, non lunari, tribuendus eſt; ut abunde probavit Cl. D. *De Mairan* in tract. de Aurora Boreali, Sect. I. Cap. I. pag. 14.

Tertio, imminutio diametri lunaris, quæ in eclipſibus ſolaribus 30″ circiter minor obſervatur quam luna in eodem anomaliæ gradu pleno orbe fulgenti; hæc, inquam, imminutio atmoſphæram lunarem minime probat, etiamſi obſerventur in diſci lunæ circumferentia quædam montium inæqualitates, quæ in luna plena penitus evaneſcunt: objecta enim lucida fibras oculi tam valide concutiunt, ut motus ipſarum fibris vicinis communicetur, & ita corporis lucidi imago ultra debitam quantitatem augetur, quod experientia pervulgata notum fiet: ſi enim palus ſeu fuſtis lunam inter & oculum ſubjiciatur, diameter pali e regione lunæ imminuta videbitur; quod ſi tunc temporis nubes aliqua planetam ſubeat, minor videtur pali deminutio; nulla eſt, ſi planetam nubes ab oculis ſurripiat; ac tandem pro varia lucis lunaris intenſitate varia obſervatur.

Quod ad montium inæqualitates attinet, eadem ratione in luna potius ſitiente, quam in luna plena, obſervari debent: montes enim lunares per ſe obſcuri, in ſolis fulgentiſſimo orbe conſpecti, longe minus oculorum aciem fugiunt, quam ubi luna plena clareſcentes vicino lunæ ſplendore extinguuntur; cum præſertim ea ſit lucis lunaris intenſitas, ut in ejus vicinia ægre admodum ſtella tertiæ magnitudinis diſcerni poſſit. Sed ut nodus hac in re penitus præſcindatur, ſi lunæ ſoli oppoſitæ limbus ejus atmoſphæræ non ipſiſſimi corporis planetæ terminus eſſet, teleſcopiis longioribus, arctioribuſque aperturis objectivis, montes in lunari peripheria numquam obſervarentur: porro tubo optico 36 ped. Pariſ. & apertura objectiva unius pollicis, multoties plurimas montium inæqualitates in lunæ plenæ diſco obſervavi; unde ſequitur lunæ plenæ diſcum ejus corporis, non atmoſphæræ peripheria terminari.

Quarto, nunc demum de mira illa Anni 1715 obſervatione fulgurum lunarium *Londini* facta * a D$^{no}$. *Delouville*, præſentibus multis REGIÆ SOCIETATIS aſtronomis, paucis eſt diſſerendum; paucis quidem; quid enim de re ante & poſt hanc eclipſin inobſervata dicendum? Si tamen aliquid in medium de tam inſolito phænomeno proferre liceat, ſupponemus limbum lunæ viſibilem ex inſitis montium cacuminibus componi; quæ quidem in eclipſi totali ſolem obſervatori eodem modo occultant, quo ſylvarum majorum arbores viſui officiunt. Unde ſi in lunæ ſuperficie quædam montium ſeries liberum in rectam lineam tranſitum radiis ſolaribus præbuerint, fulgurum quorumdam ſpeciem mentiri debuerunt, eodem modo ac ſi in camera obſcurata radius ſolis ope ſpeculi ſubito intromittatur, & ſubtrahatur objectorum externorum pictura in foco lentis exarata, tractibus luminis fulguri ſimillimis illuſtrabitur: quod quidem eo libentius admittendum cenſeo, quod iſta ſubitanea fulgura in limbi lunæ vicinia ſemper obſervata fuerint; ut ex ipſo hujus eclipſeos ſchemate * ab illuſtriſſima D. *Sara Sloane* exarato patet.

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* Obſervatio hæcce facta fuit revera a Cl. D. *Edmundo Halleio*, præſente quidem D. *Delouville*, uti videre eſt in *Tranſact.* N° 343, p. 249. *C. M.*

Quod ad pallidam illam faſciam limbum lunæ in hac eclipſi comitantem, cum in eclipſibus ſolaribus hucuſque obſervatis nil ſimile nec mihi nec cuiquam aſtronomo apparuerit; quod tamen in hypotheſi atmoſphæræ lunaris ſemper & ubique obſervari debet; nullam ejus mentionem hic faciemus.

Ex his omnibus manifeſtum eſt nihil in eclipſibus ſolis obſervari atmoſphæræ lunari conſonum. Nunc de fixarum & planetarum eclipſibus a luna differendum.

Fig. 4. Si luna atmoſphæra cingitur, planetæ & ſtellæ fixæ ſerius pone lunam occultari, & citius ab ejus diſco egredi, obſervatori in terræ ſuperficie conſtituto videbuntur, quam luna abſque atmoſphæra ſuppoſita; quin & in quibuſdam locis, in quibus videri debuiſſet planetæ vel fixæ a luna eclipſis, nulla obſervabitur: quod ut manifeſtum fiat, ſit corpus lunæ *ABC*, & ſtella in *S* diſtantia quaſi infinita poſita; radii paralleli *LV*, *MX*, lunare corpus undique contingentes, ſuperficiem cylindricam conſtituunt, cujus quidem cylindri baſis *VZX* in diſco telluris cunctas habitationes, in quibus ſtella ſeu planeta a luna tegitur, ſuo ambitu comprehendit. Obſervator itaque in *V* initium eclipſeos, & finem in *X*, conſpiciet, durationem-quo interjicitur temporis, per quod luna diametrum ſuam, ſeu potius ſpatium huic æquale percurrere poterit. Si autem lunæ atmoſphæra ſupponatur radius *IW*, axi cylindri parallelus non remanebit, & cylindrus ipſe conus evadet, cujus ſectio *YTU* habitationum in quibus debebitur eclipſis, deſignabit. Porro anguſtata baſi *YTU*, punctum *Y* ſerius habitationem ſupergredietur, quam punctum *V*; limeſque *U* citius ipſam deſeret quam *X*: ſerius ergo incipiet ſtellæ vel planetæ a luna eclipſis, & citius abſolvetur, atmoſphæra circa lunam ſuppoſita, quam luna nuda: quin & nulla obſervabitur eclipſis eo loci, ubi abſque atmoſphæra obſervari debuiſſet; locus enim *C*, circumferentia *VZX* prioris cylindri involutus, a ſectione coni *YTU* immunis erit. Porro ſuppoſita refractione horizontali in lunæ atmoſphæra æquali 8″, *VY*, 1384 hexapedas, id eſt, leucæ Pariſienſis dodrantem æquabit: unde ſequitur nullam in locis calculo indicatis eclipſin obſervari debuiſſe, quotieſcumque in cylindricam aream non magis leucæ dodrante immerguntur.

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* In Muſeo celeberrimi patris ejus Cl. D$^{n}$. *Hans Sloane*, Bart. R. S. Pr.

Aliud etiam phænomenon ex atmoſphæræ lunaris ſuppoſitione oritur: in cylindri parte *YR* ſtella quidem ſemper videbitur, ſed interpoſita atmoſphæra lunari: ideoque motum & colorem a genuino diverſum induet; idque in omnibus omnino eclipſibus, ſive ſtella ſit maxima ſive minima.

Porro, eclipſium fixarum & planetarum a luna duratio nullo modo imminuta videtur, ſed ſemper diametro lunæ, & motui ejus, præciſe conſona obſervatur. Quod ad illas attinet obſervationes, in quibus ſtella poſt contactum, in diſco lunæ paululum progredi ante occultationem videtur, ipſarum cauſam in auctam lunæ & ſtellæ diametrum penitus refundemus: ſi enim hujus apparentiæ cauſa eſſet atmoſphæra lunaris, ſemper in omnibus ſtellis, & cum quibuſlibet objectivorum aperturis, eadem obſervaretur. Porro nullam hactenus ſtellam in diſco lunæ progredientem obſervavi, niſi primæ, aut ad minimum ſecundæ magnitudinis, idque dimidia ad maximum ſui parte; & diameter vera fixarum, ut cuilibet obſervanti ſatis conſtat, inſenſibilis evadit, nec niſi a radiis ſpuriis augetur: unde radii adventitii tam ſtellæ quam lunæ in fundo oculi miſcentur ante veram corporum ſtellæ & lunæ copulam: aliunde, ſi limbus lunæ viſibilis atmoſphæræ non ipſius corporis terminus eſſet, majoribus tubis, & anguſtioribus aperturis objectivis, nulli in peripheria montes obſervarentur; qui tamen, ut ſupra dictum eſt, ſatis clare conſpiciuntur.

Ex his igitur omnibus manifeſtum erit lunam nulla atmoſphæra refringente veſtiri, cujus refractio obſervationi pateat: fieri enim poſſet, ut circa lunam exiſteret atmoſphæra, in qua refractio horizontalis ad 1″ vel 2″ aſſurgeret: huic enim opinioni ſuffragari videntur majores in luna maculæ, quæ nullo modo ſylvæ dici poſſunt, ut Clar. *Hartſoëker* & aliquibus aliis viſum fuerat. Umbræ enim marginum ſemper limbo lunæ claro viciniores obſervantur; unde recte concluditur eas cavitates eſſe non ſylvas, quæ ex altero latere umbram projicerent. Porro ſupponi poteſt in ipſis fluidum quoddam, quo quidem caſu halitus ex ipſis a ſole extolli valde phyſicæ conſonum eſſet; quorum congeries ſpeciem quamdam atmoſphæræ circa lunam mentiretur; quæ quidem atmoſphæra nec denſa admodum, quippe quæ ex Cl. *Neutoni* demonſtratis vix, cæteris paribus, tertiam halituum

terreſtrium denſitatis partem adæquaret, nec ſibi ipſi diverſis temporibus ſimilis obſervaretur, vaporibus iſtis omni alio adminiculo deſtitutis.

Multa ſunt & alia ratiocinia phyſica, quibus noſtra de atmoſphæra lunari opinio fulciri poſſet: ſed aſtronomice tantum, non phyſice, rem diſcutiendam ſuſcepimus. Lectorem ſatis in hujus operis decurſu diſtinuiſſe mihi viſus ſum: huic itaque finem impono, illuſtriſſimæ SOCIETATIS in re tam ancipiti judicium pro ipſiſſima rei veritate libentiſſime amplexurus.

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## IV. *A* Narrative *of an extraordinary* Sinking down *and* Sliding away *of ſome* Ground *at* Pardines *near* Auvergne, *ſent from M.* T— *to a Relation in* England, *tranſlated from the* French, *and communicated to the* ROYAL SOCIETY *by* Phil. Henry Zollman, *Eſq;* F. R. S.

THE Pariſh of *Pardines*, in the Diſtrict of *Iſſoire* (in *Auvergne*) is ſituate about a League from the Town of *Iſſoire* on the Road to *Clermont*, almoſt on the Top of a pretty ſteep Hill.

This Pariſh conſiſts of two Villages or Hamlets diſtant from each other about 200 Paces; the one, which is called *Le Fort*, in which is the Pariſh Church, and Part of the Houſes of the Inhabitants, ſtands upon a Rock; there appear the Remains of an antient Fortification, with which ſome Houſes were ſurrounded in the time of the Wars.

The other Village, which is properly called *Pardines*, was compoſed of the greater Part of the Houſes of the Inhabitants to the Number of 46 Buildings; the Ground whereon this Village was built, as well as that of the whole Hill, is a good and light Earth, mixed with a little white Clay: There are alſo found in it ſome Stones and Rocks of a middling Size. This Land was very well cultivated, and very fruitful, conſiſting of Fields ſowed with Corn, of Orchards, and for the greater Part of Vineyards; the whole Ground was overſpread with Fruit-trees, particularly Walnut-trees.

This Earth uſed to dry ſoon and chap from the Heat; they even obſerved in it long ſince Clefts of a conſiderable Depth, which ſometimes growing wider and wider, formed ſeveral Gullies.

On the 23d of *June* 1733. about Nine in the Evening, the Inhabitants of the Village of *Pardines* ſaw the Walls of their Houſes ſhake ſenſibly; whereupon they all retired out of them, and ſaw that the Hill viſibly melted away, as it were, the greater Part of the Land ſliding along towards the Vale; others ſubſided ſenſibly; in ſome Places the Earth, opening itſelf, formed new Gulls, and thoſe that were obſerved there before, grew much wider; ſometimes the Ground which ſlided along in great Pieces, ſtopt and tumbled one Piece over the other; and the Rocks, which broke looſe from that rolling Earth, precipitated themſelves into the Valley, which at preſent is quite filled up with them, as well as with the Earth which rolled down, whereby the Road from *Iſſoire* to *Clermont* is become impaſſable.

All this was done, not with any impetuous Motion, but very gently, and even ſometimes almoſt imperceptibly; a ſenſible Motion was obſerved during the Space of three or four Days at different times; there was even a Houſe which did not fall till the 10th of the preſent Month of *July*. During all that Time no Noiſe was heard, any otherwiſe than what proceeded from the Rocks falling into the Valley, and from ſome large Clods of Earth, which looſening themſelves from the ſteeper Parts, fell down with Precipitation.

By this Rolling were carried away 26 Buildings, large or ſmall, ſome of which ſubſided with the Ground, and, being ſhaken at their Foundations, tumbled on a Heap; the Remains of ſome others appear, as yet, on thoſe Pieces of Ground that rolled down into the Valley.

It is computed, that the Lands which ſlided away, or were loſt by being buried under the Rubbiſh of the others, amount to the Number of 466 *Oeuvres* of Vineyards, 40 *Septerées* of arable Land, and 56 *Oeuvres* of Graſs-fields, which all together may make up 150 Acres of *Paris* Meaſure. It is obſervable, that in this Number were compriſed ſeveral Orchards, beſides that the whole Ground was covered with Trees, either Walnut-trees on the Hill, or Willows and Poplars in the Valley, of which they reckon 4000 in all.

If one may conjecture what was the Cauſe of ſo diſmal an Accident, it ſeems it proceeded from the Situation of the Ground, and the Nature of the Soil. The firſt Surface of the Hill about four or five Foot deep, was a pretty light Earth, eaſily dried by the Heat of the Sun; under this firſt Layer there was a *Stratum* of fat Clay, which at preſent lies open in ſeveral Places, and which is very moiſt, ſo that one even ſees the Water bubbling out of it in ſome Places.

The great Rains that fell in the Beginning of the Spring, ſoaked through and diluted this *Stratum* of Clay, which retained and gathered all the Waters of the Hill running between the two Layers; the Heat of the Summer enſued, which dried up the upper Surface, and formed it into a ſort of ſolid Cruſt, which Cruſt reſting itſelf upon a fat and moiſt Clay, and by its ſteep Situation being inclined to ſlide towards the Valley, the whole Surface of it looſened itſelf by great Pieces, and breaking in ſeveral Places, ſlided along towards the Place whither its Declivity would naturally carry it. There are ſome Parts which moved almoſt inſenſibly, and only ſunk or ſubſided, either becauſe the Rolling of the neighbouring Soils made room, that what was under this Surface might ſlide off, or perhaps becauſe the Parts under this Surface had been hollowed a long while ſince, by the Waters which paſſed between this Surface and the *Stratum* of fat Clay. Other Parts, which were much more in Number, rolled all together towards the Valley, and one ſees yet whole Pieces of Vineyards, with the Props remaining upright; which may eaſily be conceived: There are again other Parts, which in tumbling were overturned in different manners.

I am to add here, that this Accident is not without Example in the Province of *Auvergne*; we have not indeed ſeen ſo conſiderable a one till now, yet it has often happened, that Pieces of Earth of a Quarter or Half an Acre, have ſeparated themſelves all in one Piece, from the Top of a Hill, and ſlided down viſibly on the Lands lying below.

How conſiderable ſoever this Accident may be in regard to the poor People who ſuffered by it, yet it was to be wiſhed it was the only one that has befallen this Province. The Overflowings of the River *Allier*, and of the Rivers and Brooks that run into it, and the Hail that fell almoſt continually ſince, have intirely ruined above One hundred Pariſhes, in which they will have no Harveſt this Year as for Corn and Hemp, nor any Vintage at all.

## V. *A* Diſſertation *on the* Worms *which deſtroy the* Piles *on the Coaſts of* Holland *and* Zealand, *by* Job Baſter, *M. D.* F. R. S. *communicated by the* Preſident *of the* ROYAL SOCIETY. *Tranſlated* * *from the* Latin *by* T. S. *M. D.* F. R. S.

### SECTION I.

IN the Year 1730. the Perſons appointed to take care of the Dikes on our Coaſts, obſerved that the Piles made of the hardeſt Oak, defending the

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* This is here inſerted in *Engliſh*, becauſe a very ample Treatiſe hath been publiſhed in *Latin* on the ſame Subject, intituled, *Godofredi Sellii*, J. U. D. *R. S. Lond.* S. Hiſt. Nat. *Teredinis* ſeu *Xylophagi* marini. *Tubulo-conchoïdis*, Traj. ad Rhen. 1733. 4to.

Coaſts of the *Netherlands* againſt the Sea, were eat through in a few Months, ſo as to be broken by the leaſt external Force. Surpriſed at this uncommon and dangerous *Phænomenon*, they inquired into its Cauſe, and ſaw that a ſort of Worms, before that time very ſcarce, but now increaſed to an incredible Number, had in ſo ſhort a time eat into thoſe Piles between the higheſt and loweſt Water-marks, and threatened very great Damage to the Inhabitants of theſe Countries.

The ſuperſtitious Populace immediately perſuaded themſelves, that this new Genus of Animals was created by the divine Wrath for puniſhing the Sins of Mankind: But prying Experience has taught, that thoſe Worms, like other Inſects, were created in the Beginning; but now multiplied to an incredible degree from ſome unknown Cauſe.

## SECT. II.

If a Pile of the hardeſt Oak has ſtood ſix Months on the Shore, and be taken out in Summer or Autumn, there appears Mud and Filth ſticking to its outward Surface; which being ſcraped off with a Knife, diſcovers a vaſt Number of Holes, ſcarcely as large as Pins Heads.

## SECT. III.

If you view this Mud (SECT. II.) through a Microſcope, you will ſee,

1. A Number of whitiſh Points, not bigger than Grains of Sand.
2. Some very ſmall Worms.

The whitiſh Points ſeem to be the Eggs of this Inſect, and the Worms to be ſuch as are already hatched from them; and theſe Worms gradually perforating the outward Surface of the Wood, rendered ſoft by lying in the Water, made the aforeſaid Holes, (SECT. II.) and through them worked their way into the Subſtance of the Wood.

## SECT. IV.

A ſmall Style of Whalebone or Lead, thruſt into theſe ſmall Holes, runs ſtrait into them for three or four Lines, ſo that its outer End always makes a right Angle with the Pile: But afterwards, if the Style be gently puſhed forward, it does not continue in the ſtrait Line, but runs either way, generally upward.

## SECT. V.

But if one of theſe Piles (SECT. II.) be ſplit lengthwiſe with a Hatchet or Wedge, it is found full of Paſſages, or hollow cylindrical Ducts, each of which contains a Worm, ſurrounded with a thin teſtaceous Subſtance, exactly filling the Duct, and forming its *Involucrum* or Sheath, in which Sheath it can move with Freedom. *See* SECT. XIX.

Theſe Ducts, (SECT. IV.) beginning at the outward Surface by a narrow Hole, grow gradually wider, and run either ſtrait, oblique, upward or downward. But what is moſt ſurpriſing is, that theſe Ducts never run into one another, nor communicate; but each of them continues ſeparate for every ſingle Worm. Over the Worm's Head there are found two or three Drops of a ſalt Liquor, thicker than Water, but not the leaſt Appearance of the Duſt of the corroded Wood.

### SECT. VI.

Whence it appears, that all the Wood, which had before filled up the Place of the Duct, in which the Worm with its Covering is now found, was eaten and conſumed by the Worm: And as it ſeems quite incredible, that an Animal, which appears ſoft, and almoſt as fluid as the White of an Egg, ſhould be able to eat through ſuch hard Wood; I offer the Deſcription of this *Xylophagous Worm* to the ROYAL SOCIETY, in order to give them ſome Knowledge of this Water-Inſect, which has done ſo many Millions Damage to theſe Countries.

### SECT. VII.

They are found of various Sizes and Thickneſs. There are ſome of the younger ones not above an Inch or two in Length; ſome of a middle Size, ſuch as we have repreſented in our firſt and ſecond Figures; ſee TAB. II. and ſome thirteen or fourteen Inches long.

### SECT. VIII.

But in order to a more accurate Deſcription, we will divide the Animal into Head, Body and Tail.

The Head is of a moſt wonderful Structure, being covered with two hard . . . (I know not which to call them, Shells or *Hemicrania*) of a Subſtance neither teſtaceous nor oſſeous, ſecuring their ſofter Contents: And being viewed through a Microſcope, they appear as in Figure 3. as well as I could have them drawn.

## SECT. IX.

Theſe *Hemicrania* are two white Bodies, much harder than the Subſtance which forms the teſtaceous Covering; the inner Surface hollow and ſmooth; the outer, convex and rough, with three Fibres running different ways; and both together perfectly repreſent a double Bit, of that kind of Borer, we call an Augar.

## SECT. X.

The upper Part of the external convex Surface (Fig. 3. *A.*) has a very ſharp Edge, in which the firſt Series of Fibres begins from one Point; which Fibres gradually dilating, and running lengthwiſe, end about the middle Part of it; and this middle Part makes a right Angle with the upper Part. In this Part the Fibres being elevated, run croſs-wiſe (Fig. 3. *B.*). The lower Part is thicker than the upper, but ſofter and leſs compact. In this Part the Fibres are raiſed up and rough, firſt curve, then ſtrait, and, like the others, run length-wiſe to the lower Edge of this Part, which is ſtrongly faſtened to the Head by various Ligaments (Fig. 3. *C, D.*).

## SECT. XI.

The concave or inner Part of theſe *Hemicrania*, (SECT. IX.) which contains the ſofter Parts of the Head, is very ſmooth; but almoſt in the Middle has a very ſmall and tender Eminence or Proceſs, (in Shape much like Dr. *Rau's* Proceſs in the Organ of Hearing) fixed at one End, and looſe at the other, running almoſt the whole Width and doubtleſs deſtin'd for ſupporting ſome of the inward Parts of the Head (*See* Fig. 4. *A.*).

## SECT. XII.

These two *Hemicrania*, connected together by ſtrong Ligaments, and as it were by a ſmall Hinge, (by means whereof they can dilate without ſeparateing) beſides their defending the ſoft Head from external Injuries, are the Inſtruments wherewith the Animal gets its Food. For whatever way it turns its Head, the raiſed and rough Fibres, running either length-wiſe or croſs-wiſe, always rub off ſome of the Wood.

## SECT. XIII.

Theſe *Hemicrania* carefully removed, the contained Parts (Fig. 6.) are laid open to View; but they are ſo ſoft, and of ſo wonderful a Structure, that the Eye, though armed with a Microſcope, can neither diſcern their true Make or Uſe. Firſt, indeed, there appears a Membrane enveloping the whole Head; in the middle and anterior Part, which is not covered by the ſaid *Hemicrania*, it appears as if raiſed by a *Tubercle*, (Fig. 6. *c.*) and in that Place it is of a red Colour; but the lower ligamentous Edge firmly adheres both to the ſmall Proceſs (SECT. XI.) and to the lower Edge of the *Hemicranium*.

## SECT. XIV.

This Membrane carefully ſeparated and removed, (Fig. 7. *A. A.*) in the middle of the ſubjacent Pulp you will find a ſmall Pear-like Body, perfectly pellucid, ſomewhat protuberant above the other Parts, which made the *Tubercle* in the Membrane (SECT. XII.). It is much harder than the other contained Parts of the Head and Body; ſo that it will bear cutting with the Scalpel. It is of a red Colour, as perfectly pellucid as a Drop of Water; of the Shape of a Pear, from a larger Baſis terminating in a Point. I cannot better reſemble it to any thing than to the Cryſtalline Lens of the Eye: Yet in Spirit of Wine it preſerved its Tranſparency, but its Bulk was diminiſhed (Fig. 7. *B.*).

I cannot gueſs its Uſe: It does not ſeem to me, as it does to ſome, to be the Organ of Sight; for the Worm ſeems to have no Occaſion for an Eye, as ſpending its Life in perfect Darkneſs; beſides that the inveſting Membrane is not tranſparent, and therefore would obſtruct the Sight.

## SECT. XV.

At the Sides, where the lower Edges of the *Hemicrania* do not touch one another, there is a ſort of Cavity; and in theſe Sides the harder Fibres may be diſtinguiſhed, diſpoſed in ſuch a manner, as perfectly to reſemble the Gills of Fiſh; and through them the Worm ſeems to breathe.

## SECT. XVI.

The extreme Softneſs of the other Parts of the Head prevents our coming at the Knowledge of the Uſe of the Membranes furniſhed with *Fibres* of different Tendencies, or inquiring by what Organs the Worm takes the Wood ſhaved off by the *Hemicrania*, or rough Shells; whether it does this by Suction, or not; by what Muſcles, or how acting, this wonderful Head is moved. 'Tis probable, indeed, that its Motion conſiſts in the opening and cloſing theſe Shells (SECT. VIII.) that ſhave off the Wood; and that the inner Parts have a Power to move on all Sides, as the Ball does in the Socket of the Eye; and perhaps to come forth of theſe Shells, and re-enter after taking their Food. But of theſe things there can be no Certainty, becauſe the Parts diſſolve between the Fingers.

## SECT. XVII.

The Body, viewed forward, (Fig. 2.) is of a reddiſh Colour. In the middle appears a Line, often dark-brown, often blackiſh, ſometimes not viſible, ſometimes running near half the Length. The reſt of the Animal is of a whitiſh or grey Colour.

1. If you intend to diſſect it, and examine the Inſide, you muſt firſt remove a thin Membrane ſurrounding the whole Body, which for that Reaſon may be called the *Cutis* or *Cuticula*. When this is removed, there appears an oblong Veſſel placed in the Middle, (Fig. 2.) of a reddiſh Colour, from the ſhaved Wood, of which it is full: Hence it ſeems to be the Stomach, or at leaſt the firſt Organ of Digeſtion.

2. In the lower Part you will find another Veſſel, appearing like a dark-brown Line, which contains the Excrements, of which it is often found full, and diſcharges them at the End of the Tail.

3. At the Sides of the reddiſh Veſſel or Stomach (SECT. XVII. 1.) is placed a white, clammy, fat Subſtance, ſticking to the Fingers, and perhaps conſtituting the Fleſh of the Animal.

## SECT. XVIII.

Where the Body ends, the Tail begins, thicker than the Body, and rendered ſtronger by circular *Fibres*. At its End it has two ſmall hard Bodies, containing and defending the tender Extremities of the Tail.

This Tail thicker than the Body terminates in two Ends, the thickeſt of which certainly ſerves for the Diſcharge of the Excrements, the ſlendereſt doubtleſs for Generation: And this it can ſtretch out to an incredible Length, ſo that in Worms that ſeemed to be in Copulation, it appeared above an Inch out of the Pile.

The two ſmall Bodies, that contain theſe Ends of the Tail, are of a harder Subſtance than even the *Hemicrania*. The outer Part is gibbous, the inner hollowed. The lower End is bifid; whence I conjecture, that they ſerve the Animal for Feet, when it is mounting upright, or corroding the Wood; by leaning on them as on a Prop (Fig. 8.).

## SECT. XIX.

The above-deſcribed Worm dwells now very ſecurely in a teſtaceous Tube of a white Colour, which it exactly fills, yet ſo as to be able to move with Freedom. That Tube, like the Coverings of Snails, *&c.* daily grows with the Animal, from the Matter which perſpires from its Body; whence it is ſometimes found ſtrait, ſometimes bent, according to the Courſe which the Worm ſteered in corroding.

## SECT. XX.

As to their Generation, it is probable enough, that, analogous to that of other Inſects, it is performed by Copulation of Male and Female: For they can ſo lengthen one End of their Tail, and thruſt it out of the Pile, that they may copulate by that means. Then they lay their Eggs in the Water cloſe to the Piles, to which they ſtick by their clammy viſcid Matter, (ſuch, for Example, as Frog's Spawn) and afterwards, by the Heat of the Sun, hatch the Worm, which immediately endeavours to get into the Pile (See SECT. II. and III.).

I could not obſerve the Difference of Sex, either with my Eye, or a Microſcope. Some think them Hermaphrodites, as Snails, and that they copulate in the ſame Manner: But theſe Conjectures are not very probable.

## SECT. XXI.

Many Remedies and Secrets for deſtroying theſe dangerous Enemies were immediately boaſted of, which for the moſt part were Preparations of *Arſenic* or *Mercury*, and are not worth enumerating: I will only give the Receipt of one, which is the beſt and ſureſt of all.

Take an Iron Plate of an oblong Figure, and of the Width of the Pile, with a ſtrong Handle at each End. One End of this Plate muſt be armed with thick Nails half an Inch long, and about an Inch aſunder. The Nails of this Plate muſt be driven into a Pile of any ſlight Wood, with a Hammer, and then the Plate pulled off by means of its Handles.

And

And this is to be ſo often repeated until the Pile is perforated every-where with ſmall Holes: Then it muſt be dawbed over with *Varniſh* in the hotteſt Sun (the *Varniſh* is imbibed by the ſoft Wood with ſo many Holes in it); and while the *Varniſh* is yet hot, let it be ſtrewed over with *Brick-duſt*: And this is to be repeated three or four times, after the preceding *Varniſh* is thorough dry, till the Pile is intirely ſurrounded with a ſtony Cruſt, which will be impenetrable to all Inſects, and laſt many Years.

But the Divine Clemency has already ſo far deſtroyed theſe pernicious Inſects, which multiplied ſo prodigiouſly for eight or nine Years paſt, that there is great room for Hope, that our Country will in a ſhort time be intirely freed from them.

## *An Explanation of* TAB. II.

Fig. 1. The Pile-worm of its natural Size, lying on its Belly.

Fig. 2. The ſame lying on its Back.

### *See* SECTION XVII.

*A.* The Stomach.

*B.* The Duct full of Excrements.

*C.* The Tail, with its Defences *dd*, and its Point *e*, which it can ſtretch out.

*The Six following Figures are repreſented much larger than Life.*

### SECT. X.

Fig. 3. *AA.* The firſt Series of Fibres running ſtrait down.

*BB.* The ſecond Series running tranſverſely.

*CC.* The third taking a different Courſe.

*DD.* The lower Edge, which is infixed to the Head.

### SECT. XI.

Fig. 4. The Shell or *Hemicranium* ſeen on the Inſide with the Proceſs running croſs it, one End of which *A* is fix'd, the other *a* is moveable.

### SECT. XII.

Fig. 5. *A.B.C.D.* The ſame as in Fig. 3.

*E.* The Hinge, whereby theſe are connected, and may eaſily dilate or open.

### SECT. XIII.

Fig. 6. *AA.* The Membrane covering the Head freed from the *Hemicrania*, which were attach'd to this Membrane.

*B.* The Place, where the *Hemicrania* were connected.

*c.* The middle anterior Part, in which the *Tubercle* was prominent.

### SECT. XIV.

Fig. 7. *AA.* The Membrane of Fig. 6. ſeparated and turned back.

*B.* The pellucid pyriform Body lying in the middle of the Head, and which formed

*c.* The *Tubercle*.

SECT. XVIII.

Fig. 8. The two Defences of the Tail, of which the exterior Part *A.* is gibbous, the other or interior *B.* is, as it were, hollowed: Theſe Extremities are bifid. *C.* By this Part they are joined to the Tail.

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## VI. *Two Obſervations of* Exploſions *in the* Air; *one heard at* Halſted *in* Eſſex, *by the Rev. Mr.* A. Vievar, *Miniſter of that Place; the other by* Sam. Shepheard, *Eſq;* *of* Springfield *in the ſame County.*

ON *Sunday* the 12th of *March* 1731-2. between One and Two o'Clock in the Afternoon, walking in my Garden by the Side of a Canal, I heard as it had been a large Clap of Thunder from the North-Eaſt, being a very clear Day, and no Clouds appearing. While I was looking into the Air, the Noiſe was repeated very loud, but ſeemed more like the violent Fall of a Houſe, inſomuch that I expected every Moment an Out-cry from the Town: But I was ſoon undeceived, when it began again, and I found it made towards me, with a different Noiſe from what I had heard, that is, like the Grinding of Flint-ſtones, but very loud: The Dimenſions of it ſeem'd to be about three Foot wide. I found it ſink in the Air, and as it ſeem'd to point directly at my Head, I laid myſelf down upon a Graſs-ſlope, to let it paſs over me. However, at the upper End of the Walk I found it fell to the Ground, and came rolling down the Graſs-walk; and I can compare it to nothing better than to that of a violent Grinding of Flint-ſtones, or a Coach and Six upon the full Speed upon a Cauſway of looſe Stones. I lay attentive, expecting to ſee ſomething, and ſaw a Piece of Wood came running before it. When the *Phænomenon* came to the Water-ſide, it twiſted up a large Stake that ſtood in its way, and toſſed it towards me with much Violence, and immediately fell into the Water with the Violence and the Noiſe of a red-hot Mill-ſtone. I have ſeen the Seas break againſt a Rock in a Storm, but never ſaw a greater Ferment cauſed by the boiling of the Waters. It ſtaid about a Quarter of a Minute in the Water, and then mounted again into the Air, and went rattling away, but with much leſs Violence: I heard it for about a Quarter of a Mile, and loſt it.——*N. B.* It came againſt the Wind, and not faſter than a Man may walk. The Froth and Foam upon the Water remained thirty Hours after, when I ſhewed it to ſome Friends.

Halſted *in* Eſſex, *A. Vievar.*
1731-2.

## *Part of a Letter to* W$^{m.}$ Woodford, *M. D.* *Fellow of the* College of Phyſicians, London.

——UPON *Tueſday* the 15th Inſtant, between Eleven and Twelve, the Sun ſhining very bright and hot, without the leaſt Cloud, the Wind ſo calm, that the Water was as ſmooth as Glaſs, I was dreſſing in my little Room next the Garden, about forty Yards from the Canal, when I heard a very ſurpriſing Noiſe of Fire, reſembling, as I told you at *London*, as if a very large Quantity of Oil had been thrown into a great Bonfire, burning in its greateſt Rage. I ſtepp'd immediately to the Window which was open, where I ſaw the Middle of the Canal, which this dry Seaſon has ſunk about ſix Inches, in extreme Agitation, as rough as the *Thames* in a Storm, foaming and ſmoaking, and forced up, to my Appearance, full two Foot above the Surface, but it might be much more, my Window being greatly higher than the Canal; and the Fellow who was at Work, whom I examined again this Morning, proteſts he ſaw the Water, like the Spray of the Sea, above the Dwarf-Trees, which muſt neceſſarily be five or ſix Foot. I wiſh I had ſeen the Beginning of this uncommon *Phænomenon*, the Duration of which, I think, might be half a Minute, and made the Houſe ſtink, as if a Gun had been fired in it.

My Canal bears Eaſt and Weſt, and the Fellow ſays he heard it coming from the Weſt, bringing the Leaves of ſome tall Trees from an adjacent Field in its Paſſage; but could not diſcover any material or ſubſtantial Body to fall in the Water, where the Hiſſing, as I obſerved above, was very loud and violent; neither was there any Lightning or Thunder before or after, but the Day remain'd bright, ſtill, and hot. I forgot to ſay, the Space of the Canal that was affected by it, might be twelve or fifteen Yards.

*Sam. Shepheard.*

Springfield *in* Eſſex,
Aug. 22. 1732.

TAB. I.

Philo. Trans. N° 456.

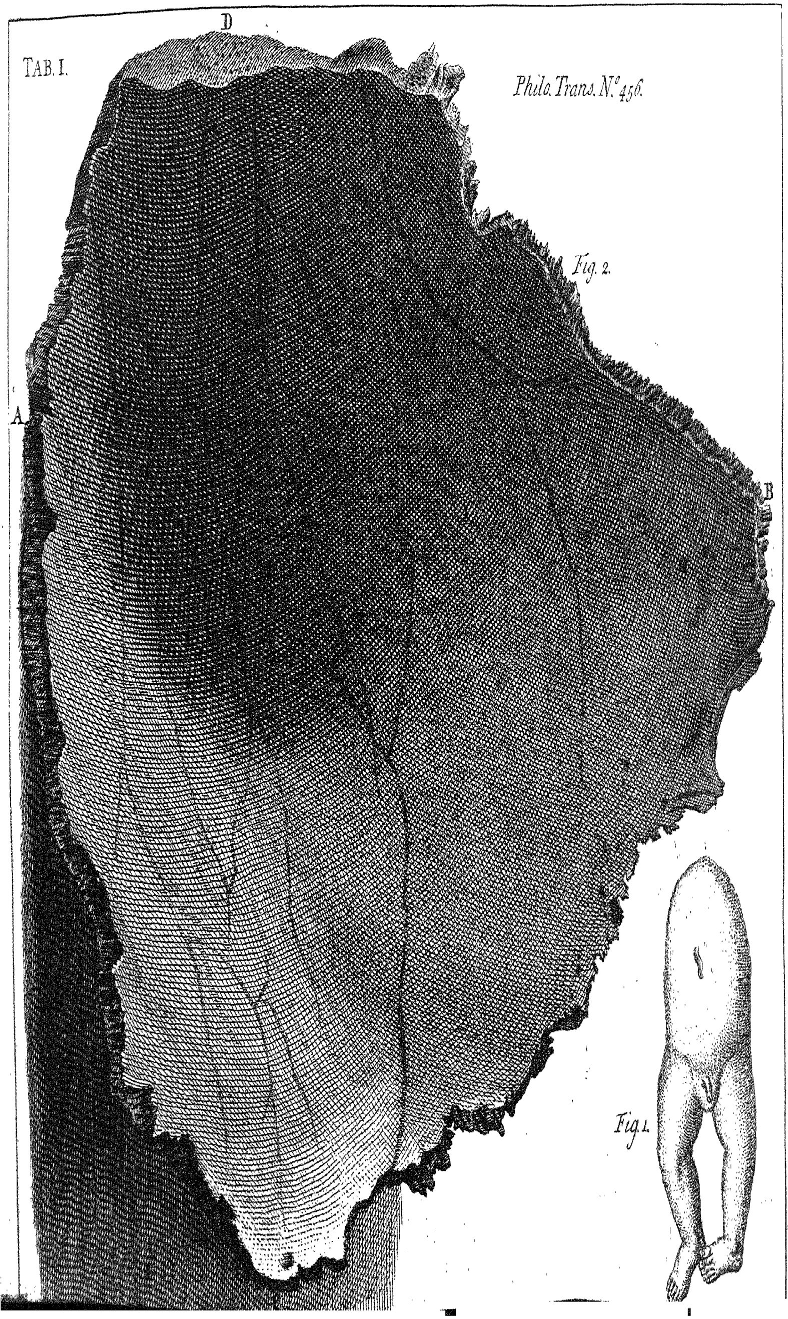

Fig. 2.

Fig. 1.

TAB. II.

Philo. Trans. N° 456.

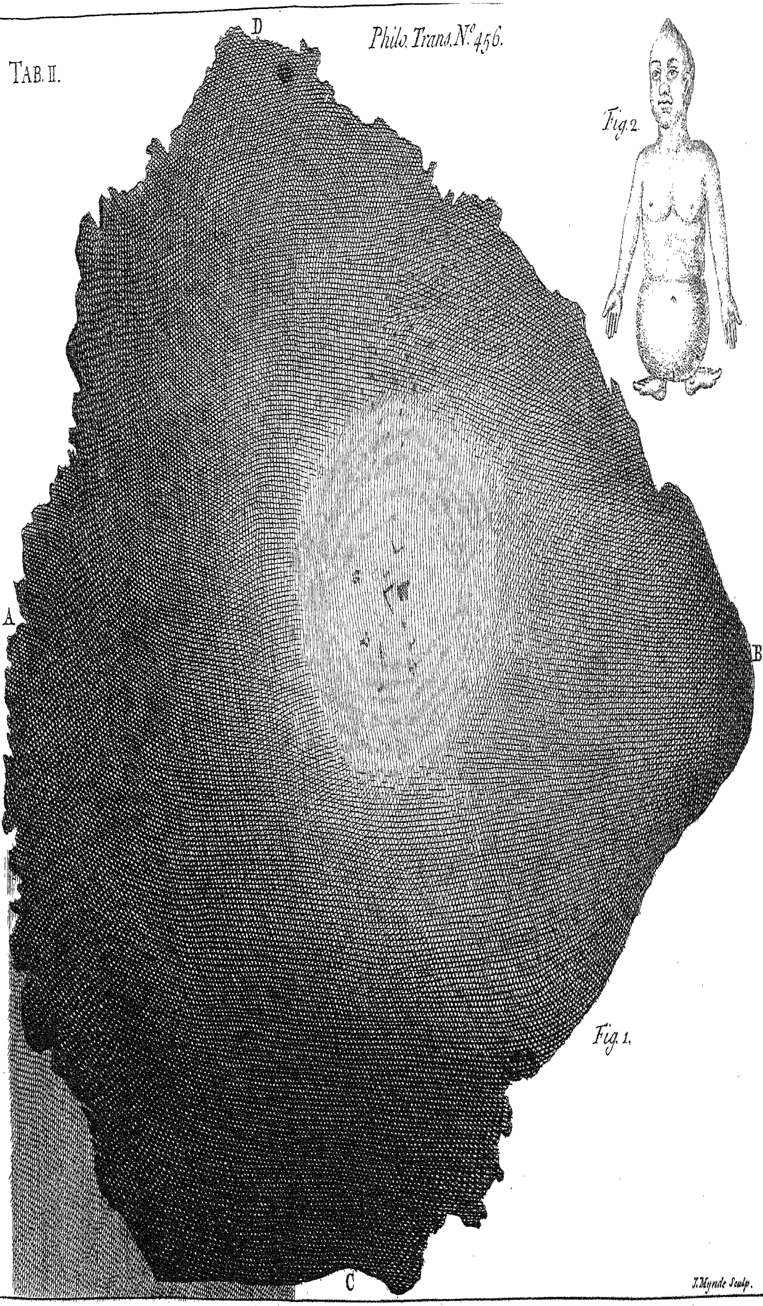

Fig. 2.

Fig. 1.

J. Mynde Sculp.

Numb. 456.

# PHILOSOPHICAL TRANSACTIONS.

For the Months of *January*, *February*, *March*, *April*, *May*, and *June*, 1740.

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II. *Some Reflections on* Generation, *and on* Monſters, *with a Deſcription of ſome particular* Monſters: *By* Daniel de Superville, *Privy-Counſellor and chief Phyſician to his moſt Serene Highneſs the Margrave of* Brandenburg-Bareith, *Preſident of the College of Phyſicians, Director of the Mines and of all Medicinal Affairs in the Margravite, Member of the Imperial Academy* Naturæ Curioſorum, *and of the Royal Society of* Berlin.

III. *Oſſis Bregmatis* Giganteæ *Magnitudinis Icon*, TAB. I. Fig. 2. & TAB. II. Fig. 1. *cum Problemate de* Gigantis Statura *determinanda ſecundum Regulas Artis Delineatoriæ: quæ ad Illuſtr.* REGALIS SOCIETATIS *Præſidem D$^{um}$* Hans Sloane, *Bart. tranſmiſit* Jac. Theodor. Klein *Reipubl.* Gedan. *a Secretis*, & Reg. Soc. Lond. *Soc.*

IV. *An Account by the Rev.* Zachary Pearce, *D. D.* F. R. S. *of a Book intituled*, Reflexions Critiques ſur les Hiſtoires des Anciens Peuples, *&c.* Paris, 1735. 4°. *in* 2 *Vol.*

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I. *A*

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*ERRATA.*

Pag. 308. l. 11. *lege* Tab. I. *Fig.* 2. & Tab. II. *Fig.* 2.
12. *pro* adjuncta, *l.* adpicta,
34. *dele* (Tab. II.)

# I. *A* Catalogue *of the* FIFTY PLANTS *from* Chelſea *Garden, preſented to the* ROYAL SOCIETY *by the Company of* Apothecaries, *for the Year* 1738. *purſuant to the Direction of Sir* Hans Sloane, *Bart. Med. Reg. & Soc. Reg. Præſ. By* Iſaac Rand, *Apothecary,* F. R. S. *Hort. Chel. Præſ. ac Prælec. Botan.*

801. ADONIS; Hellebori radice; Buphthalmi flore. H. L. Bat.

802. Anonis Alopecuroides, mitis, annua purpuraſcens. H. Elt. 28.

803. Aſteriſcus; Coronæ Solis flore & facie. H. Elt. 42.

804. Carduus galactites. J. B. III. 54.

805. Caryophyllata Alpina, lutea. C. B. 322.

806. Chamælæa tricoccos. C. B. 462.

807. Chenopodium Ambroſioides; folio ſinuato. T. 506.

808. Chenopodium Ambroſioides, Mexicanum. T. 506.

809. Clinopodium Americanum; Salicariæ foliis perforatis; Pulegii odore.

810. Clinopodium; Menthæ folio, incanum & odoratum. H. Elt. Tab. 74.

811. Cnicus Hiſpanicus, arboreus fœtidiſſimus. T. 451.

812. Crocus, vernus, latifolius, flavus. C. B. 66.

813. Crocus Vernus latifolius; flore albo purpuro-violacea baſi. C. B. 66.

814. Crocus albus variegatus; fundo floris flaveſcente.

815. Delphinium Platani folio, *Staphyſagria* dictum. T. 428.

816. Doronicum Plantaginis folio. C. B. 184.

817. Eryngium cœruleum, albis maculis notatum, H. Ox. III. 165.

818. Eryngium montanum, Amethyſtinum. C. B. 386.

819. Hyoſcyamus albus, major, vel *tertius* Dioſcoridis, & *quartus* Plinii. C. B. 169.

820. Hyoſcyamus major, albo ſimilis; Umbilico floris atro-purpureo. T. Cor. 5.

821. Hyoſcyamus luteus, minor fruteſcens.

822. Jaſminum humilius, magno flore. C. B. 398.

823. Iris tuberoſa; folio anguloſo. C. B. 40.

824. Laſerpitium anguſtifolium majus; ſegmentis longioribus & indiviſis. H. Ox. III. 321.

825. Laſerpitium foliis latioribus; ſemine criſpo, & verrucoſo. H. Ox. III. 320.

826. Laſerpitium humilius; Paludapii folio; flore albo. T. 325.

827. Laſerpitium; lobis anguſtioribus, & dilute virentibus, conjugatim poſitis. H. Ox. III. 321.

828. Laſerpitium; lobis anguſtioribus, longioribus & dilute virentibus, plurifariam diviſis. Pluk. Phyt. Tab. 198. F. 6.

829. Laſerpitium, lobis minimis trifidis; ſeminum alis fere planis.

An *Laſerpitium anguſtiore folio, umbella concava & contracta. Pluk. Phyt.* Tab. 199.

830. Lavandula anguſtifolia. C. B. 216.
*Lavendula* Officinarum.

831. Lavandula latifolia. C. B. 216.
*Spica Nardus Germanica.* Trag.

832. Leonurus minor; Capitis Bonæ Spei, vulgo. Boerh. 180.

833. Limonium minimum; flagellis tortuoſis, noſtras.

834. Linaria annua, anguſtifolia; floſculis albis, longius caudatis. Triumph.

835. Matricaria vulgaris, ſeu ſativa; caulibus rubentibus. H. L. Bat.

836. Meniſpermum Canadenſe, ſcandens; umbilicato folio. Ac. R. Sc. 1705.

837. Meniſpermum; umbilicato folio, mucronato, ad baſin non ſinuato.

838. Meniſpermum; Hederacco folio.

839. Pinus, Halepenſis; foliis tenuibus læte viridibus.

840. Polium erectum minus anguſtifolium.
An *Polium Hiſpanicum tenuifolium, flore albo, capitulo breviori.* T. 207.

841. Populus nigra; folio maximo; gemmis Balſamum odoratiſſimum fundentibus. Cateſ. Hiſt. Tab. 34.

842. Saxifraga, rotundifolia, alba. C. B. 309.

843. Saxifraga, verna, annua, humilior. T. 252.
*Sedum tridactylites tectorum.* C. B.

844. Serratula Marilandica; foliis glaucis Cirſii inſtar denticulatis. H. Elt. 354.

845. Stramonium; foliis ſubrotundis ſinuatis & denticulatis.

846. Thapſia latifolia, villoſa. C. B. 348.

847. Verbena Bonarienſis, altiſſima; Lavendulæ Canarienſis ſpica multiplici. H. Elt.

848. Virga aurea Marilandica, cæſia, glabra. H. Elt. 414.

849. Virga aurea Novæ Angliæ, lato, rigidoque folio. Par. Bat.

850. Virga aurea, vulgaris, latifolia. J. B. II. 1062.

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## II. *Some Reflections on* Generation, *and on* Monſters, *with a Deſcription of ſome particular* Monſters: *By* Daniel de Superville, *Privy Counſellor and chief Phyſician to his moſt Serene Highneſs the Margrave of* Brandenburg-Bareith, *Preſident of the College of Phyſicians, Director of the Mines and of all Medicinal Affairs in the Margravite, Member of the Imperial Academy* Naturæ Curioſorum, *and of the Royal Society of* Berlin. *Tranſlated from the* French *by* Phil. Hen. Zollman, *F. R. S.*

IT cannot be denied, that ſince the middle of laſt Century to this Time, very important Diſcoveries have been made in Natural Hiſtory: However, thoſe Diſcoveries are very inſignificant, in compariſon to what is ſtill concealed from us. We have ſome

Knowledge of the coarſer ſort of Nature's Operations, but the Niceties, the Particulars of them, eſcape us. If we endeavour to puſh our Knowledge ſo far, we find ourſelves ſurrounded with Clouds, we grope in the dark, and it is very difficult, if not impoſſible, to catch Nature in the Fact. It even ſeems, we have had better Succeſs in determining what Nature does not do, or cannot do, than in ſpecifying what ſhe actually does.

The Human Body is a Compound of Springs, which produce very regular Motions: Yet theſe Springs themſelves we do not know but very ſuperficially, and are far from knowing how thoſe Motions are produced. We know, that we are born, that we exiſt; but how came we to this Exiſtence? How were we produced? The Generation of Mankind and of Animals is one of thoſe *Phænomena*, where innumerable Experiments have not been of ſo great Uſe, as they are elſe in other *Phænomena* of Natural Philoſophy, for diſcovering their moſt ſecret Springs.

It is ſtill a Diſpute, whether the Male or the Female contributes moſt towards Generation. It is certain, that for the Generation of Mankind there muſt be a Male and a Female, and it is the ſame thing with regard to that of Brutes. There is all the Reaſon in the World to believe, that what is written about Hermaphrodites, and about thoſe Animals which, being endued with the Advantage of the two Sexes, produce alone their Like, has not been examined with all the neceſſary Attention and Exactneſs.

The *Semen* of Man, which is certainly a moſt neceſſary Agent for Generation, becauſe it has been obbſerved, that thoſe who have none, or do not eject t according to certain requiſite Conditions, are not it for multiplying their own Species: This *Semen*, I ſay, is a Liquid full of ſmall Worms. It would e abſurd to deny it: All exact Obſervators have taken Notice of them, and offered to ſhew them to the incredulous. I have obſerved theſe *Animalcula* in human *Semen*, in that of ſeveral Quadrupedes, and in that of ſome Birds. I have obſerved, that the Figure of theſe *Animalcula*, as to Birds, was different from that of other Animals. I have preſerved *Animalcula* in a proportionable Warmth alive for ſeveral Hours; I have obſerved their Strength and Livelineſs to leſſen by Degrees, and at laſt intirely to ceaſe; and I have obſerved them dead, not ſwimming any longer, but always ſinking to the Bottom. I have obſerved in the *Semen* of Men, who had a virulent *Gonorrhœa* upon them, thoſe *Animalcula* to be without Motion, and like dead. I might inlarge upon the Particulars of a greater Number of Obſervations; they all prove the real and conſtant Exiſtence of *Animalcula* in the *Semen* of Males.

Theſe Worms, according to ſome Natural Philoſophers, are true *Embryoes*. As ſoon as an *Animalculum* has entered into an Egg, the Female who carries the Egg in her Body, has conceived; ſhe harbours it, nouriſhes it, and contributes towards the ſhaping of it, until it becomes an Animal, too big to be any longer contained in ſo ſmall a Place, and ſtrong enough to bear the Air.

According to other Natural Philoſophers, the Eggs that are in the *Ovaria* of the Females, contain the Image, the Type, the Picture of the *Embryo*; and the ſubtile Vapour of the Male *Semen*, or rather the occult Quality of that Seed, impregnating one of thoſe Eggs, immediately fixes that Image, and makes a real *Embryo* of it.

Theſe latter intirely deny the Exiſtence of *Animalcula* in the Seed, becauſe they have not ſeen them; and if they are ſhewn them, they maintain that they are foreign Beings; or, that they are a particular ſort of Worms, who form a ſeparate Claſs among thoſe Inſects: That God created them to exiſt in the Seminal Liquid, that they keep in it as in their Element, that they multiply there, and that they continue there and die, ſuch as we obſerve them by the Microſcope.

I do not pretend to decide, that the former are intirely in the Right; they maintain an Hypotheſis founded on ſome Probabilities. Alas! who can hope upon ſo dark and hidden a Subject to find a demonſtrated Syſtem? The ſecond Opinion ſeems to me unwarrantable: It is founded upon Words which have no Reality. How can one form to himſelf the Idea of a Vapour extremely ſubtile and active, that ſhall have the Faculty of giving Life and Motion to an Image, to a Type, in ſhort, to a thing that was not real? The Pre-exiſtence of the *Embryo* in the Egg can by no means be demonſtrated: Even by the Help of the beſt Microſcopes, there is never any thing found in thoſe Eggs, but a clear and limpid Liquid.

I keep among my Curioſities ſix oſſified Eggs, which I found in the *Ovaria* of a Woman who died at the Age of Sixty. They are not all of the ſame Bigneſs. I broke two of them, and examined their internal Structure with all the Attention imaginable; but found nothing there except oſſeous Fibres, iſſuing from the Centre towards the Superficies; there was not the leaſt Appearance of an *Embryo*, nor of its Image.

One muſt have an Imagination extremely prepoſſeſſed to perſuade one's ſelf, that there is an organized Body in the Liquid contained in thoſe Eggs: Or, it requires a very particular Natural Philoſophy, to pretend to demonſtrate, that a bare Vapour (more ſubtile than any the moſt ſpirituous Vapours we know of) could, by its ſimple Touch or Friction, produce an organized Body, where there was none.

The Generation of Mankind as well as of Brutes by the means of the *Animalcula*, which are obſerved in the *Semen* of Males, ſeems more analogous to all that we ſee Nature do for the Production and Multiplication of the Vegetables. There needs no Imagination for forming to one's ſelf an Idea of it. Each *Animalculum* is an *Embryo*, is a ſmall Animal of the ſame Species with that which harbours it: As ſoon as it finds itſelf diſengaged from the Confinement in which it was, and in a Place where it meets with a Humour proper for its Vegetation and Expanſion, it takes Root there, it ſwells like a Corn newly put into the Earth, it ſpreads itſelf, its Members ſhape themſelves, and by degrees take more Strength and Conſiſtence, its Parts grow longer, and diſentangle themſelves, as it were, from all thoſe Plaits and Folds in which they were confined before, and the *Embryo* becomes a *Fœtus*.

I own, that the immenſe Number of *Animalcula*, which are obſerved in the Seminal Liquid of Man, ſeems to oblige one to reject this Hypotheſis, and particularly this Opinion, that every *Animalculum* is an *Embryo*. For it is certain, that in every Man there would be enough of them to people a vaſt Country, and of all that immenſe Quantity there are but a few that come to any thing. And ſo, there you have Millions of little Men, created never to exiſt; which ſeems directly contrary to the wiſe Intentions of the CREATOR, who, in all Likelihood, made nothing in vain. But *Teleology* is one of thoſe Parts of Philoſophy, in which there has been but little Progreſs made, wherein one reaſons only by Conjecture, nor can demonſtrate any thing otherwiſe than *à poſteriori*. Who dares preſume ſo far as to pretend to penetrate into all the Deſigns of the ALMIGHTY, and into the divers Ends He has propoſed to Himſelf in the Creation of the Univerſe? Beſides, it is certain, that half of Mankind periſh, before they come to the Age of one Year, that is to ſay, before they can know themſelves, before they can anſwer the Ends GOD propoſed to Himſelf when He created them. Would one ſay therefore, that their Exiſtence was uſeleſs? But moreover, this ſeemingly uſeleſs Quantity of *Animalcula* equally affords an Argument againſt the Hypotheſis of thoſe, who believe the *Embryo* is in the Egg. One cannot maintain, that all the Eggs in the *Ovaria* are fruitful. And ſo there we have equally an immenſe Quantity of Types of *Embryo's* created for nothing, and abſolutely uſeleſs; and it will follow from both Hypotheſes, that GOD might have ſaved Himſelf the Trouble of creating ſo prodigious a Quantity of Creatures in order to precipitate them into nothing. But who ares ſay, that the creating ſo many Millions of reatures more has coſt Him any more Pains? And y what could one prove, that all thoſe *Animalcula*, hich do not come to the State of a *Fœtus*, are nnihilated?

The Hypotheſis of the Generation by *Animalcula* n the Seminal Liquid of Man, appears ſupported nd confirmed by ſeveral Experiments. *Leewenhoek* as already obſerved, that a wild Male Rabber, and a ame and white Female, produce young ones intirely eſembling the Father; and that it is a Cheat very ommon in *Holland* to ſell that ſort of Rabbets, for wild ones, and that it is only by the Taſte one can find out the Truth. There is among domeſtic Animals a ſort of Poultry without Tails, and another ſort with the Feathers turned upwards; if a Cock without a Tail is put among ordinary Hens, or a Cock with the Feathers upwards, all the Chicks will prove like the Cock: The ſame Experiment may be made with Pigeons, with Canary-Birds, *&c.*—— A Mule ſprung from an Aſs and a Mare, reſembles more to the Aſs than to the Mare, whereas a Mule coming from a Horſe and a She-Aſs, has more of the Horſe's Nature. All this proves in ſome meaſure, that the Male furniſhes the moſt eſſential Part in the Generation, *viz.* the *Embryo*.

By the ſame Hypotheſis ſome *Phænomena* obſerved in Generation, may be more eaſily accounted for. *Hippocrates* believed that the Difference of the Sexes depended on certain Diſpoſitions in the Seeds of the Male and the Female; that when the Male was the moſt vigorous in the Copulation, they begot Males; but if the Seed of the Female prevailed, they produced only Females. This Opinion, abſurd as it is, has been followed and maintained by ſeveral celebrated Phyſicians. How can one believe, that a little more of I do not know what, (for they do not determine wherein the more or leſs of the Virtue in the Seed muſt conſiſt) a little more Activity, a little more Spirituouſneſs, ſhould compoſe, ſhould determine any Organization? It is more natural to believe, that every *Animalculum* has already the Sex it is to have when it comes into the World. It has been diſputed Tooth and Nail, to determine the Time when the *Fœtus* becomes animated, and to know from whence and how its Soul enters into its Body. According to the moſt general Opinion, there muſt be at every Conception a new Creation of a Soul: Or, according to others, there is always a Legion of created Souls fluttering about in the Air, and watching the Minute for entering into a fruitful Egg as ſoon as it is impregnated. What an Extravagance is this! Would it be as abſurd to believe, that every *Animalculum* has already its Soul, which waits only for the little Machine's unfolding itſelf in order to exert its Function?

According to the Hypotheſis of *Animalcula*, one may eaſily account for thoſe monſtrous Births, when two *Fœtuſes* are joined together, or Children and Animals are double, in the Whole or in Part. I keep in my Collection a Pig, that has eight Feet; the two Bodies, that are ſeparated, reunite themſelves by the *Spina Dorſi* below the *Diaphragma*, and have but one viſible Neck ſupporting a Head, bigger than it ſhould be, on which there appear four Ears, three Eyes, and the Snout ſeems double. I have alſo the e Head of a Foal, which is double, and has three yes. I have a *Turkiſh* Duck, which is double, the wo Bodies are joined by the Breaſt; each Body has wo Wings, and two Legs; but they have only one Neck with one Head. I keep a Chicken, which has ſecond Rump fixed to its Breaſt, with the two Legs, nd two Paws. I even have a Frog, which beſides its four Paws, has a Fifth as well formed as the others, which comes out at the Right Shoulder. The Production of all theſe Monſters that are double, or have ſuperfluous Members, may very well be occaſioned by two *Animalcula* entring into the ſame Egg; they touch, they cloſe, they unite, they crowd each other: The Parts of the weakeſt, being too much crowded, cannot extend nor diſplay themſelves; ſo they vaniſh, as it were, ſo much the eaſier as they are extremely tender, and without any ſenſible Conſiſtency.

It is not more difficult to find plauſible Reaſons for imperfect Monſters, or that have an odd Conformity, as to the Whole, or as to ſome of the Members. I have the *Fœtus* of a Sheep which has no Noſe; the Part where the Noſtrils ſhould be, ſeems to be flayed, and the two Eyes are there one by the Side of the other. On the Forehead there is a ſmall Trunk of about an Inch and a half long, and pierced at the End by two Noſtrils. I have another, which has but one Eye in the Middle of the Forehead. I have a human *Fœtus* of about ſeven Months, which has no Mark of the Sex, and inſtead of the Legs there is a Bag that runs to a Point, the Extremity of which is cartilagineous: In that Bag there is a Bone three Inches long, covered with a muſcular Fleſh;

it is articulated with the *Os Sacrum*; the *Oſſa innominata* are wanting, and below the *Anus*, which is upon the Middle of the *Os Sacrum*, there is a ſmall Tail like that of a Pig.

When I was at *Stetin* in *Pomerania*, about 12 or 14 Years ago, a Midwife came to tell me, that a Sergeant's Wife was delivered of three dead Children, one of which had no Head. I immediately went, and obſerved, that theſe *Fœtuſes* had died at different times. One began already to corrupt, and the *Epidermis* ſevered itſelf at the leaſt Touch. The Monſter without a Head was alſo already quite flabby, and the third ſeemed to have died but a few Hours before. I examined the Monſter; there was no Appearance of any Head, and inſtead of the Navel there was a ſmall Lump of ſpungy Fleſh of the Bigneſs of a large Strawberry. About the *Secundines* I found but two *Placentas*, and two Coats; ſo that this Monſter muſt abſolutely have been in one of thoſe Coats with another *Fœtus*. The Midwife was not skilful enough to give me an Account of the Delivery: I put Queſtions to the Mother, who aſſured me ſhe felt one Child dying three Weeks before, and that the laſt died the Evening before. I offered a good Sum of Money to have all ſhe was delivered of, but they would not let me have it. I ſtill offered Money to have only Permiſſion to diſſect the Monſter, but the impertinent Superſtition of the Parents deprived me of that Satisfaction.

I ſtill preſerve in my Collection a monſtrous *Fœtus*, which deſerves particular Attention. It is of eight Months, without Head or Arms: The Figure [*See* Tab. I. Fig. 1.] is here annexed, which outwardly ſeems to be nothing elſe but the *Abdomen* ith the Legs; theſe are well-ſhaped and propor-oned, with the Toes, and the Beginning of the ails; the Right Foot however is, as it were, crooked, d bending inwards. Having opened it, I found deed but one Cavity, which in the upper Part ontains a ſmall Bladder. There is not in all the avity any thing beſides a Bit of Inteſtine, the two idneys, the Bladder, and the Right Teſticle, which y upon the Ring. The Fleſh was hard, and, as it ere, *carcinomatoſe*. The Navel-ſtring went in a ttle higher than naturally, and a little towards the ight Side, entering into the Inteſtine. There is a lender Inteſtine of about 14 Lines in Length, pro-eeding from the ſame Place, where the Navel ntered into the Cavity; next comes the *Cœcum* with its vermicular Appendix, the *Colon* and the *Rectum*, the Whole together of the Length of about wo Feet. Theſe Inteſtines go from above to below n *Zic-Zac*, and are attached to the *Spina Dorſi*. There is no Footſtep of the Heart, the Lungs, the Stomach, the Liver, the Spleen, the Pancreas, the Meſentery; all that is wanting. The ſmall Bladder I mentioned was fleſhy, and contained ſome Sero-ſity; it is attached to the firſt of the *Vertebras* of the Neck. This Beginning of the *Spina* is bent forwards like a Bow, and forms the Monſter's Round-neſs from above. The bended Extremity kept the little Bladder, as it were, under, and ſhut up in the Cavity cloſed up by the Ribs. This Cavity was to form the *Thorax*, but the *Sternum* was wanting as well as the *Diaphragm*.

*Deſcartes* and *Lanciſci* would in vain have looked out here for the Seat of the Soul, and the *Punctum Saliens* would prove very hard to be determined in this *Fœtus*. But I do not now intend to inlarge upon it. The Buſineſs is to find ſome plauſible Reaſons about the Origin of thoſe ſorts of Monſters I have now deſcribed.

The Opinions of moſt of the Natural Philoſophers on this head may, upon the main, be reduced to theſe two Hypotheſes: 1. That Monſters are original, that is to ſay, that even in Conception the Monſter is conceived. 2. That they are not produced but by Accident. One may conclude from what I have ſaid about double Monſters, that I believed them accidental; and I believe, rigorouſly ſpeaking, they are ſo, whatever they be: For ſuppoſing every *Animalculum* to be an *Embryo* created, I cannot imagine them to be created imperfect. Their Imperfection, their Deformity, may proceed from a thouſand Accidents, either in the *Reſervoirs* where they are contained, or in the different Routs they are obliged to take going from Father to Son. In this Caſe it may eaſily happen, that they are Monſters, even in the Moment of Conception, though they be ſuch by Accident. To how many Accidents are they not ſubject afterwards in the Venter of the Females? A Fall of the Mother, a ſtrong Preſſure, a Contuſion, *&c.* may diſorder the nice and tender Structure of that little Creature ſo far, that a great many of its Parts do not unfold themſelves any longer, are deſtroyed, or have their Order and natural Situation intirely changed.

The diſturbed and diſordered Imagination of the Females ought alſo to be ranged among the accidental Cauſes of Monſters. I have ſeen in a Sow juſt ſlaughtered ſeven Pigs, which all had the bloody Mark of the Knife about their Necks. About ſome twenty Years ago, a Cloth-ſhearer in *Holland* had the Miſfortune to fall into the Hands of ſome drunken young Fellows, who murdered him, and ſtabbed him with more than twenty Wounds with their Swords. He was to be married that very Week: His Sweatheart ſaw his Corpſe naked with all thoſe Wounds, and was two Days after delivered of a dead Child, which had the Marks of the Wounds in the ſame Places of its Body, where the Mother had obſerved them on her dead Lover.

I very well know, that theſe ſorts of Inſtances, of which one might alledge ſome Hundreds, will not go down with certain People, who deny the Effect of the Mother's Imagination on the *Fœtus*. They lay Streſs on two principal Reaſons: 1*ſt*, It is pretended, that the *Fœtus* has no immediate Connexion with the Mother who carries it. But this is ridiculous; for one cannot deny, that the *Secundines* are cloſely united to the *Matrix*, and receive from the Mother a Humour, or a Liquid, which by the Navel-ſtring it remits to the *Fœtus*. It is by that way it receives its Nouriſhment, that is to ſay, the Matter neceſſary for its Increaſe. Accordingly one may ſay, that the *Fœtus* owes part of its Being to the Mother; and that the Liquid which runs in the Veſſels of the Mother, runs likewiſe in the Veſſels of the *Fœtus*. 2*dly*, It is ſaid, that it is incomprehenſible how the Soul of the Mother can have an Effect on the Child. I own I do not comprehend it neither. It does not follow from thence, that we ought to reject as falſe all that our Reaſon cannot penetrate into. When once the Exiſtence and the Nature of the Soul has been demonſtrated, when once we have a perfect Knowledge of the Manner how an immaterial Being acts upon Matter, we ſhall then reaſon in Conſequence about what the Soul can do, and cannot do. Daily Obſervations demonſtrate to us, that the diſordered and diſturbed Imagination of Women often hurts the Infants. And this is a Reaſon, which I add to all the others, to think I have good Grounds to conjecture, that all Monſters are accidental; and to believe, that by the Hypotheſis of *Animalcula* one may better explain the *Phænomena* which are obſerved in Generation, than by any other Hypotheſis known as yet.

## II. *Oſſis Bregmatis* Giganteæ *Magnitudinis Icon; cum Problemate de* Gigantis Statura *determinanda ſecundum Regulas Artis Delineatoriæ: quæ ad Illuſtr.* REGALIS SOCIETATIS *Præſidem* $D^{um}$ Hans Sloane, *Bart. tranſmiſit* Jac. Theodor. Klein *Reipubl.* Gedan. *a Secretis & Reg. Soc. Lond. Soc.*

EX celebri muſeo, quod Amſtelodami fuit, Wittſeniano, os bregmatis giganteum *, cujus altitudo 9 poll. Angl. latitudo 7 (TAB. I.) una cum deſcriptione & adjuncta figura †, altitudinem capitis a mento ad verticem 20 poll. latitudinem ad tempora 12 poll. (TAB. II.) repræſentante, necnon aliud ejuſmodi os, cujus altitudo 5 $\frac{6}{8}$ poll. Angl. latitudo 5 poll. ſed ſine figura & relatione ad caput anno 1728 nactus, facile invenire potui, aſſumtis ſecundum regulas artis delineatoriæ octo capitis altitudinibus, ſtaturam gigantis fuiſſe 13 ped. 4 poll. alterius vero oſſis bregmatis, quod inſolitum quoque ſimulabat caput, juſtam rationem & quidem juxta regulas mathematicas ſcire cupidus, viro excellentiſſimo *Henrico Kühn*, J. U. D. & Athenæi *Dantiſcani* matheſ. P. P. meritiſſimo, ſequens propoſui Problema:

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* *Vid.* Catal. Muſ. *Wittſen.* p. 82.

† A pie defuncto *Ruyſchio* comparatis.

Si in duobus corporibus humanis diverſæ ſtaturæ fuerit,

In Priore,
Oſſis bregmatis altitudo 9 poll. Angl.
——————latitudo 7.
Integri capitis altitudo 20.
—————— latitudo 12.

In Poſteriore,
Oſſis bregmatis altitudo $5\frac{6}{8}$ ſeu $\frac{46}{8}$ poll. Angl.
——————latitudo 5.
Integri capitis altitudo ignota.
——————latitudo ignota.

Determinare ignotum, & rationem ſtaturæ prioris ad poſteriorem definire.

CUJUS TRIPLEX RESOLUTIO, hæc:

Si corpora iſta forent ſimilia, res breviſſime expediri poſſet, inferendo; ut in priore corpore, oſſis bregmatis altitudo ad integri capitis, vel etiam integri corporis, (tanquam illius octuplam) altitudinem, ita in poſteriore corpore, oſſis bregmatis altitudo vel latitudo ad integri capitis, vel etiam integri corporis, altitudinem quæſitam; quoniam vero 9 ad 7, & $\frac{46}{8}$ ad 5 ſunt rationes diſſimiles, corpora iſta ſimilia non ſunt. Quamobrem opus eſt, ut in calculo & altitudinum & latitudinum oſſium bregmatis ratio habeatur; uti ex triplici methodo ſubjecta apparebit.

## METHODUS PRIMA.

iat α.) $9'' : 20'' = \frac{46''}{8} : \left\{ \begin{array}{l} \text{altitud. capitis quæſitam} \\ \frac{20\,.\,46''}{9\,.\,8} \end{array} \right.$

it hujus octuplum $= \frac{8.\,20.\,46''}{9.\ 8} = \frac{20.\,46''}{9} = \frac{920''}{9}$

$= 102\frac{2}{9} \left\{ \begin{array}{l} = 8 \text{ ped. } 6\frac{2}{9} \text{ poll.} \\ = \text{ſtaturæ corporis ſecundi.} \end{array} \right.$

Fiat β.) $7'' : 20'' = 5'' : \left\{ \begin{array}{l} \text{altitud. capitis quæſitam;} \\ \frac{100''}{7}. \end{array} \right.$

it hujus octuplum $= \frac{800''}{7} = 114\frac{2}{7} = 9$ ped. $6\frac{2}{7}$ poll.

= ſtaturæ corporis ſecundi.

Fiat γ.) Staturarum inventarum additio, & ſummæ biſectio, pro obtinendo medio arithmetrico, erit $\frac{8', 6''\frac{2}{9} + 9', 6''\frac{2}{7}}{2} = \frac{17', 12''\frac{1}{2}}{2}$ quam prox.

$= \frac{18' + \frac{1}{2}''}{2} \left\{ \begin{array}{l} = 9 \text{ ped. } \frac{1}{4} \text{ poll.} \\ = \text{ſtructuræ corporis ſecundi} \end{array} \right.$

proxime veræ.

## METHODUS SECUNDA.

(Fiat) $9'' + 7'' : \frac{46''}{8} + 5'' = 20''$ : altitud. capitis [poſterioris.

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$$\text{h. e. } 16 : \frac{46 + 40}{8} = 20'' : \ldots\ldots$$

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$$\text{h. e. } 16 : \frac{86}{8} = 20'' : \begin{cases} \text{altitud. capitis poſterioris} \\ \frac{20.\ 86''}{16.\ 8} = \frac{5.\ 86''}{4.\ 8} = \frac{430''}{32} = \frac{215''}{16} \end{cases}$$

$$\text{erit hujus octuplum} = \frac{8.\ 215''}{16} = \frac{215''}{2.} = 107''\tfrac{1}{2}$$

$$\begin{cases} = 8 \text{ ped. } 11\tfrac{1}{2} \text{ poll.} \\ = \text{ſtaturæ corporis ſecundi proxime veræ.} \end{cases}$$

Id quod cum priori calculo ſic ſatis conſentit, cum differentia $\frac{3}{4}$ pollicis non excedat.

## METHODUS TERTIA.

Quoniam in diverſorum corporum partibus cognominibus (e. g. in duobus oſſibus bregmatis) ſuperficies partium ſunt inter ſe, ut quadrata altitudinum corporum integrorum; nec minus ſuperficies iſtæ ſint inter ſe, ut facta ex altitudinibus partium in latitudines: erunt etiam facta ex altitudinibus partium in ſuas latitudines inter ſe, ut quadrata altitudinum corporum integrorum. Quare, cum altitudo corporis prioris ſit 20″, adeoque ejus octuplum, ſeu altitudo inntegri corporis prioris, ſit 160″, cujus quadratum eſt 5000″; fiat

| altitud. bregmat. prioris. | in | ejus latitud. | : | altitud. bregm. poster. | in | ejus latitud. | = | quadratum altitudinis, prioris corporis integri. | : | quadratum altitudinis, poſterioris, corporis integri. |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | · | 7 | : | $\frac{46}{8}$ | · | 5 | = | 25600″ | : | ..... |

$$\text{h. c. } 63 : \frac{230}{8} = 25600'' : \frac{230.25600''}{63.\ 8} = \frac{230.3200''}{63}$$

Cum itaque ſit $\frac{230.3200''}{63} = \frac{736000''}{63} = 11682''\frac{1}{2}$ quam proxime, = quadrato ſtaturæ corporis ſecundi; erit (radice quadrata ex 11682 extracta) ipſa corporis ſecundi ſtatura quam proxime vera = 108 = 9 ped. 0 poll. Angl. Quæ ipſa ſtatura, cum ſit inter ſupra inventas media, pro accuratiſſima eſt habenda.

Denique, cum octo capitis altitudines pro ſtatura corporis humani integri ſatis recte aſſumere ſoleamus, & capitis gigantei prioris altitudo ſit 20 poll. Angl. erit ſtatura gigantis prioris = 8 . 20″ = 160″ = 13 ped. 4 poll. Angl. Conſequenter ſtatura gigantis prioris eſt ad ſtaturam poſterioris, ut 13 *pedes*, 4 *pollices* ad 9 *pedes* in menſura Anglicana, ſeu ut 160″ ad 180″ ſeu ut 40 ad 27.

## IV. *An Account by the Rev.* Zachary Pearce, *D. D.* F. R. S. *of a Book intituled*, Reflexions Critiques ſur les Hiſtoires des Anciens Peuples, *&c.* Paris 1735. 4°. *in* 2 *Vol.*

MONS. *Fourmont* is well known to the learned World for ſome curious Pieces which he has already publiſhed, and for very many others in almoſt all Languages, which he has prepared for the Preſs, and the Titles of which he has given us in a Catalogue of his Works printed at *Amſterdam* 1731. in 8vo.

This Work of his, which now lies before the Society, is intituled, *Reflexions Critiques ſur les Hiſtoires des Anciens Peuples*, &c. lately printed at *Paris*, in 2 Vols. in 4to, at the Expence of ſome *French* Gentlemen of his Acquaintance, as he tells us in the *Advertiſement* placed before his *Preface*.

His general Deſign is to ſet right the Hiſtory of the moſt antient Nations, particularly the *Chaldeans*, *Hebrews*, *Phœnicians*, *Egyptians*, *Greeks*, &c. down to the Time of *Cyrus* the Founder of the *Perſian* Empire.

The Work conſiſts of three Books.

In the Firſt of which he gives us at Length the famous Fragment of *Sanchoniathon* the *Phœnician*, as tranſlated by *Philo Byblius*, and preſerved by *Euſebius* in his *Præparatio Evangelica*, Lib. I. cap. 9.

With this Fragment he has publiſhed a *French* Verſion of it, in which he endeavours to diſtinguiſh between the Account given by *Sanchoniathon* the Au-

Author, and what he ſuppoſes to be the Additions of *Philo* the *Greek* Tranſlator.

After this he examines into the Reaſons brought by ſeveral of the Learned *for* and *againſt* the Genuineneſs of the Fragment, and determines in favour of it with as much Weight of Argument as the Queſtion will admit. He then takes Notice of a Treatiſe, written on the ſame Subject as his own, by our learned Countryman Biſhop *Cumberland*; and having examined and declared his Diſlike of the Biſhop's Scheme in the main, he prepares his Reader to expect full Satisfaction from his own, which makes the Subject of his ſecond Book.

In his ſecond Book, he undertakes to reconcile the Generations of Men ſet forth in *Sanchoniathon's* Fragment, with thoſe which are recorded by *Moſes* of the Patriarchs before and for ſome time after the Flood.

By the Help of *Hebrew*, *Phœnician* and *Egyptian* Etymologies, he often makes the Names, which at firſt Sight are almoſt all quite unlike, to be the ſame in Sound, or at leaſt in Senſe. And by this Application of his Skill in the antient Languages, he readily finds out a Coincidence between *Moſes's* and *Sanchoniathon's* earlieſt Generations.

But his main Work, and what he appears moſt pleaſed with, is his Diſcovery of *Abraham* and his Family among the later Generations recorded by *Sanchoniathon*. Having laid down (upon good Grounds, as he aſſures us) that *Ouranos* is *Terah*, the Father of *Abraham*, he undertakes to prove, that *Abraham* is the *Cronus* of *Sanchoniathon* and the *Saturnus* of the *Latins*; that *Sarah* (his Wife) is the ſame with the Goddeſs *Rhea*; that *Iſhmael* (*Abraham's* Son) is the *Mûth* of *Sanchoniathon*, and the *Dis* or *Pluto* of the *Greeks* and *Romans*: That *Iſaac* (*Abraham*'s other Son) is the ſame with the *Sadid* of *Sanchoniathon*, with *Jupiter* among the *Latins, and* Ζεὺς among the *Greeks*, his Wife *Rebecca* being *Juno*; that *Eſau* (*Iſaac*'s eldeſt Son) is *Oſiris* and *Bacchus*, and that *Jacob* (the youngeſt) is *Typhon*. And, in like manner, he finds a very great Part of the *Grecian* Theology in *Abraham*'s Family.

In the mean while his Readers will, perhaps, make two very material Obſervations on this extraordinary Diſcovery of his: The one, that *Cronus*'s Character in *Sanchoniathon*'s Fragment, is the moſt immoral and tyrannous of any recorded there: And how to reconcile this with the Character given in Scripture to *Abraham*, as *the Friend of God*, the *Father of the Faithful*, &c. is no eaſy Task: It requires (to be ſure) more than a Reſemblance of two or three Circumſtances, common to *Cronus* and *Abraham*, when their Hiſtorians in Fifty other Circumſtances make their Characters eſſentially different. The other Conſideration, which occurs, when we read this Treatiſe, is, that *Abraham* had ill Luck indeed, if, when he left his native Country becauſe of the Riſe of Idolatry there, all the groſſer Idolatry of the Heathen Nations after his Time took its Riſe from him and his Family: The very Crime which he took Pains to avoid, he was the accidental Occaſion of, if he and his are to be thus placed at the Head of the Heathen Theology.

The Author, having finiſhed this remarkable Part of his Work, enters into a very learned Detail of the particular Gods of the ſeveral Heathen Nations, who are moſt celebrated in Hiſtory; and he has ſhewed a great Compaſs of Reading upon this Occaſion. Hardly any Writer has been more copious on the Subject, or has given better Hints for clearing up many Paſſages of ſacred and profane Story.

In his third Book he has treated at large about the Dynaſties of *Egypt*, and the Shepherd-Kings who reigned there: Both of them, perhaps, the darkeſt Spots in the whole Face of Antiquity. He has taken great Pains to fix the Epochs of the Kings of *Sicyon*, *Sidon* and *Tyre*, of *Arabia*, *Aſſyria*, *Lydia*, of the *Medes* and *Babylonians*; concerning all which he has laid together the moſt remarkable Teſtimonies of the Antients. At length he comes to his favourite Point, the *Chineſe* Hiſtory, and gives us (as he ſays) a complete Liſt of their Kings, from the Flood down to the preſent Monarch of that Empire, and ſhews that the Chronology of the *Chineſe* may be made pretty nearly conſiſtent with the true Chronology of the *Old Teſtament*.

And for this Part of the Work the Author ſeems well fitted, being skill'd (as he tells us in his *Preface*) in the learned Characters of that Country, which he has ſtudied for near twenty Years, and has for ſome time taught in the Royal College at *Paris*; and having compoſed five Dictionaries, and a Grammar of that Language, together with a Tranſlation, almoſt intire, of the Geography of *Tamim*, which contains no leſs than the whole Hiſtory of that Empire: On which Occaſion he applies to himſelf, and the Progreſs which he has made in the *Chineſe* Learning, thoſe expreſſive Verſes of *Virgil* in his Sixth Book of the *Æneid:*

*——Pauci, quos æquus amavit*
*Jupiter, aut ardens evexit ad æthera virtus,*
*Diis geniti, potuere.*

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## V. *A* Query *propoſed to ſuch curious Perſons as uſe the* Greenland Trade, *occaſioned by the annexed Letter from Mr.* David Nicolſon, *Surgeon, to Dr.* Mortimer, *Sec.* R. S.

“ WHether the *Scurvy-graſs* of *Greenland* be the
“ ſame Species, as to its external Appearance,
“ with the common *Scurvy-graſs* of *England*?
“ And, having no acrid Taſte while growing in
“ *Greenland*, doth it, being brought growing in
“ Earth from *Greenland*, gradually acquire an acrid
“ Taſte, as it is brought into a warmer Climate?”

*SIR*, *London, Dec.* 16. 1730.

I Communicate this as Matter of Truth, and not Hypothetic, *viz.* That the *Scurvy-graſs* in *Greenland*, equally the ſame with ours in *England*, as to the Figure of the Plant, and all its Appearance to the Eye, changes its Nature much, as it approaches the Sun; for in that Climate, its principal Quality, the volatile Salt, is neither pungent nor perceiveable; but to the Taſte, the whole Plant is intirely as inſipid as the Colwort or Beet. So by my Endeavour, eſerved ſome Plants with their natural Earth, and ught them to *London* alive; and I obſerved the markable Change produced by the Sun's Heat on me for the ſaline Matter in *Greenland*, which tainly was analogous to a fix'd Salt, became, in a nth's time, almoſt to the ſame Volatility as that ich naturally grows in *England*.

This I make mention of, in caſe other Gentlemen, o have had the ſame Opportunity, have been niſs in their Curioſity.

*David Nicolſon.*

## I. *A Letter from* Edmund Stone, F. R. S. *to* ——— *concerning two Species of* Lines *of the* Third Order, *not mentioned by Sir* Iſaac Newton, *nor Mr.* Sterling.

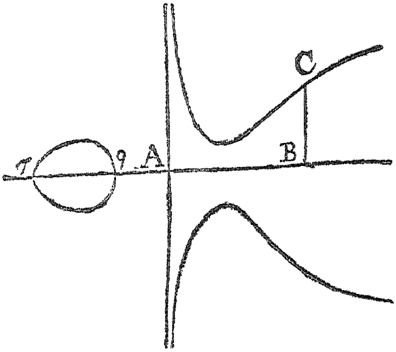
*SIR,* *July* 31. 1736.

HAVING for ſome time paſt been reading and conſidering the little Treatiſe of Sir *Iſaac Newton*, intituled, *Enumeratio Linearum tertii Ordinis*, as alſo the ingenious Piece of Mr. *Sterling*, called, *Illuſtratio Tractatus* Domini Newtoni *Linearum tertii Ordinis*; I have obſerved, that they have neither of them taken Notice of the two following Species of Lines of the Third Order; and venture to affirm, that the Seventy-two Species mentioned by Sir *Iſaac*, together with the Four more of Mr. *Sterling*, and theſe Two, making in all Seventy-eight, is the exact Number of the different Species of the Lines of the Third Order, according to what Sir *Iſaac* has thought fit to conſtitute a different Species.

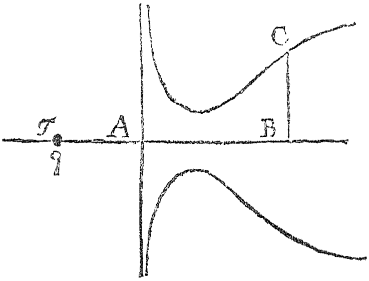
The two Species I mean, are to be reckoned amongſt the Hyperbolo-parabolical Curves, having one Diameter, and one Aſymptote, at No. 8. of *Newton*'s Treatiſe, or Page 104. of Mr. *Sterling*'s; whoſe Equation is $xyy = \pm bx^2 \pm cx \pm d$; which will give, not Four, as in theſe Authors, but Six Species of theſe Curves: For,

I. If the Equation $bx^2 \pm cx + d = 0$, has two impoſſible Roots, the Equation $xyy = bx^2 \pm cx + d$, will (as they ſay) give two Hyperbolo-parabolical Figures equally diſtant on each ſide the Diameter *AB*. See the 57th Figure in *Newton*'s Treatiſe, and this is his 53d Species, and *Sterling*'s 57th.

II. If the Equation $bx^2 - cx + d = 0$, has two equal Roots both with the Sign $+$; the Equation $xyy = bx^2 - cx + d$, will (as they ſay) give two Hyperbolo-parabolical Curves croſſing each other at the Point $\tau$ in the Diameter. See Fig. the 58th in *Newton*; and this is his 54th Species, and *Sterling*'s 58th.



III. But if the Equation $bx^2 + cx + d = 0$, has two poſſible unequal negative Roots $A\rho$ and $A\tau$, the Curve given by the Equation $xyy = \pm bx^2 + cx + d$, will conſiſt of two Hyperbolo-parabolical Parts, as alſo of an Oval on the contrary Side the Aſymptote or principal Abſciſs. And this is one of the Species omitted by Sir *Iſaac* and Mr. *Sterling*, which is really the 59th Species.



IV. Alſo if the Equation $bx^2+cx+d=0$, has two equal negative Roots $A\rho$ and $A\tau$; the Curve given by the Equation $xyy=\pm bx^2+cx\pm d$, will conſiſt of two Hyperbolo-parabolical Parts, and alſo of a Conjugate Point on the contrary Side the Aſymptote or principal Ordinate: And this is the other Species of theſe Curves omitted by Sir *Iſaac* and Mr. *Sterling*, which is really the 60th Species.

V. If the Roots of the Equation $bx^2-cx+d=0$, are real, and unequal, having both the Sign $+$; the Curve given by the Equation $xyy=bx^2-cx+d$, will (as they ſay) conſiſt of a conchoidal Hyperbola and a Parabola, on the ſame Side the Aſymptote or principal Ordinate. See Fig. the 59th in *Newton*; and this is really the 61ſt Species.

VI. If the Roots of the Equation $bx^2+cx-d=0$, have contrary Signs, the Equation $xyy=bx^2+cx-d$, will (as they ſay) give a conchoidal *Hyperbola* with a *Parabola* on the contrary Side the Aſymptote or principal Ordinate. See Fig. the 60th in *Newton*; and this is really the 62d Species. I remain

*Your humble Servant,*

Edmund Stone.

VII. *An*

# VII. *An Account of an Improvement on the* Terreſtrial Globe, *by* Joſeph Harris, *Gent.*

THE Globe is juſtly reckoned very uſeful and inſtructive, both as a general Map, and alſo for explaining the firſt Principles of Geography, and the ſpherical Doctrine of Aſtronomy. By this Inſtrument it is eaſy to find the Length of the Days, and their Increaſe and Decreaſe, in all Places, and at all Times of the Year. But this is not uſually performed in ſuch a manner as at the ſame time to explain how theſe *Phænomena* ariſe from the Motion of the Earth, which is the principal thing Beginners eſpecially ſhould have in View: Nor can this be remedied, at leaſt but in few Caſes, as Globes are commonly fitted up; for the Axis and the horary Circle prevent the Braſs Meridian from being moveable quite round in the Horizon, which it ought to be, and ſo indeed prevent the Globe from being univerſally uſeful, even in the common way of conſidering it.

It is now about Six Years ſince I removed this Impediment, by placing two horary Circles under the Meridian, one at each Pole. Theſe Circles are fixed tight between two Braſs Collars placed about the Axis, but ſo that they may be eaſily turned by the Hand when the Globe is at Reſt; and when the Globe is turned, they are carried round with it, the Meridian ſerving as an Index to cut the horary Diviſions. The Globe, being thus fitted, ſerves readily for ſolving of Problems in South as well as in North Latitudes, as alſo in Places near the Equator. But the chief Advantage gained by this Alteration, is, that the Globe is now adapted for ſolving of Problems upon the Principles of the *Pythagorean* Syſtem, or to ſhew how the Viciſſitudes of Days and Nights, and the Alterations of their Lengths, are really made by the Motions of the Earth. To expedite this, I had the Braſs Meridian at one of the Poles divided into Months and Days, according to the Sun's Declination, reckoning from the Pole. This being done, if we bring the Day of the Month to the Horizon, and rectify the Globe according to the Time of the Day, the Horizon will repreſent the Circle ſeparating Light and Darkneſs, and the upper Half of the Globe, the illuminated Hemiſphere, the Sun being in the Zenith.

While we view the Globe in this Poſition, we ſee the Situations of all Places in the illuminated Hemiſphere, with reſpect to the Horizon, Meridian, *&c.* and by obſerving the Angles which the Meridians, cutting any Parallels of Latitude in the Horizon, make with the Braſs Meridian, we have the Semidiurnal Arches of theſe Parallels reſpectively: And at the ſame time (if the Sun be not in the Equator) we ſee why the Diurnal Arches of the Parallels continually decreaſe from the Neighbourhood of the elevated Pole, till we come to the oppoſite Part of the Horizon. If we turn the Globe Eaſterly round its Axis, we ſhall ſee how all Places change their Poſitions with reſpect to the general Horizon, the Meridian, *&c.* by the Motion of the Earth round her Axis.

It yet remains to be ſhewed, how the annual Motion of the Earth in her Orbit, cauſes the Change of the Sun's Declination: This cannot be done by the Globe ſimply taken, but is very well ſhewed by the Inſtruments called *Orreries*: But to theſe their Coſtlineſs is an Objection, not mentioning others from a want of due Proportion in the things they exhibit. I had therefore an Inſtrument made, which conſiſted only of a round Trencher of Wood, a Circle of Braſs upon the Face of it, and between theſe three Wheels of the ſame Dimenſions and Number of Teeth: The innermoſt Wheel was fixed to the Wood in the Centre, the third had its Axis come through the braſs Plate, round which was a braſs Circle having a Socket making an Angle with it of 66½ Degrees; in this Socket was fixed the Axis of a little Globe, having an Horizon about it, to repreſent the Circle ſeparating Light from Darkneſs, the Sun being ſuppoſed to be in the Middle of the Inſtrument. While the braſs Plate is turned round through the Scale of Months and Days expreſſed on the under Plate, the Axis of the *Terrella* is kept all the while parallel to itſelf, by means of the ſecond Wheel placed between the two above-mentioned; and ſo the Change of the Sun's Declination, or rather, which comes to the ſame Purpoſe, the different Poſition of the Equatorial Axis with reſpect to the Circle ſeparating Light and Darkneſs, is exhibited all the while the Earth is going round in her Orbit. By placing the Axis of an ivory Ball having one half blacked, upright in the middle of the Circle which carries the *Terrella*, this little Inſtrument will ſerve to explain the *Phænomena* of the Moon's *Phaſes*.

Having thus learned the Cauſe of the Sun's Change of Declination, we may now have recourſe to the larger Globe, and moving it according to the different Seaſons, we may obſerve the *Phænomena* thence ariſing more diſtinctly.

For a graduated Meridian, I had a flexible Slip of Braſs divided into Degrees, which I could fix occaſionally in the two Hour Circles; and upon ſuch another Slip I had a Scale of Months, anſwering to the Sun's Declination, reckoning both ways from the Equator. By means of this graduated Meridian, the Globe being rectified according to the Sun's Declination, if we gently turn it round its Axis, we may preſently find the Time of the Sun's riſing or ſetting in all Places, by obſerving the Hour Circle, when the ſeveral Degrees of Latitudes reſpectively come to the Horizon.

After the ſame manner, if the Globe be elevated to any particular Latitude, and the Meridian having the Scale of Months be fixed in its Place, we may ſoon find the Time of the Sun's riſing or ſetting in that Latitude throughout the Year, by obſerving the Hour Circle when the reſpective Days come to the Horizon. This Method is not only uſeful on the Account of its being expeditious, but alſo becauſe it intimates, why at the ſame time the Days are of different Lengths in different Latitudes, and in the ſame Latitude at different Times of the Year.

The Globe-makers might ſave us the Trouble and Expence of having theſe graduated Slips of Braſs, by dividing ſome Meridian, which goes over the leaſt Land, into Degrees, which might be marked with round Dots, and every Tenth numbered. The Scale of Months might be engraved upon ſome other Meridian. It would be of Uſe likewiſe, if the Parallels and Meridians of every Degree between the Tropics be drawn in faint Lines, which I think might be done without obſcuring the Map.

Parallel to the Horizon, and 18 Degrees below it, I had a Circle fixed for ſhewing the Limits of the Twilights: This is uſeful, as it ſhews at one View the State of the Twilights, and alſo why they do not lengthen or ſhorten, as the Days do. The Semicircle of Poſition is a thin narrow Plate of Braſs as uſual, but made ſo that its Axis is moveable quite round the Horizon. I had alſo a narrow flexible Slip of Braſs, which might be girt round the Globe in any Poſition, and ſo be made to repreſent any great Circle whatſoever: This occaſional Circle may be inſtructive to Beginners on ſeveral Occaſions.

If the principal Horizon be of Wood, or made ſo as to obſcure the Globe below it, the Twilight Horizon had beſt have ſmall Feet of a proper Length fixed ſo that it might ſtand in its proper Place upon the other, occaſionally; then inverting the Poſition of the Globe, the ſame thing will be ſhewed as before.

The farther Uſe and Application of theſe Contrivances to different Projections of the Sphere, *&c.* will be obvious to thoſe who are acquainted with theſe things; and without dwelling any longer upon this Subject, it may ſeem, that I have already ſaid more than was needful in this Place. But the Globe being in every-body's Hands, and in reality a very uſeful, entertaining and inſtructive Inſtrument; I

thought

thought an Attempt to render it more ſo, would not be altogether uſeleſs, or yet unworthy the Notice of the Curious.

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## VIII. *A new Method of improving and perfecting* Catadioptrical Teleſcopes, *by forming the* Speculums *of* Glaſs *inſtead of* Metal. *By* Caleb Smith.

THE Teleſcope is deſervedly reckoned one of the moſt excellent of all the Inventions of the Moderns; ſuch noble and uſeful Diſcoveries have been made by means of this admirable Inſtrument, and are ſtill to be expected from its further Improvement, that many of the moſt eminent Mathematicians have imployed their utmoſt Skill and Induſtry to bring it to Perfection.

The Imperfections of Teleſcopes are attributed to two Cauſes; to wit, The Unfitneſs of the Spherical Figure to which the Glaſſes are uſually ground, and the different Refrangibility of the Rays of Light.

The firſt of theſe Defects only, was known to the Writers of Dioptrics, before Sir *Iſaac Newton*; for which Reaſon (as he informs us himſelf, *Opt. Lect.* 1, 2.) they "imagined, that Optical Inſtruments "might be brought to any Degree of Perfection, "provided they were able to communicate to the "Glaſſes, in grinding, what Geometrical Figure they "pleaſed; to which Purpoſe various Mechanical "Contrivances were thought of, whereby Glaſſes "might be ground into Hyperbolical, or even Parabolical,

“ bolical, Figures; yet nobody ſucceeded in the “ exact Deſcription of ſuch Figures; and had their “ Succeſs been anſwerable to their Wiſhes, yet their “ Labour would have been loſt (continues this “ incomparable Mathematician); for the Perfection “ of Teleſcopes is limited, not ſo much for want of “ Glaſſes truly figured, according to the Preſcriptions “ of Optic Authors, (which all Men have hitherto “ imagined) as becauſe that Light itſelf is an heterogeneous Mixture of differently refrangible Rays; “ ſo that were a Glaſs ſo exactly figured as to collect “ any one ſort of Rays into one Point, it could not “ collect thoſe alſo into the ſame Point, which “ having the ſame Incidence upon the ſame Medium, “ are apt to ſuffer a different Refraction” (*Phil. Tranſ.* N°. 80.). And again,——“ Diverſa diverſorum Radiorum Refrangibilitas Impedimento eſt, “ quo minus Optica, per Figuras, vel ſphæricas, vel “ alias, perfici poſſint; niſi corrigi poſſint Errores “ illinc oriundi, Labor omnis in cæteris corrigendis “ imperite collocabitur” (*Principia, &c. Scholium ad finem Libri Primi).*

Now, for this principal and laſt-mentioned Defect, no one, that we know of, has propoſed any Remedy; apprehending, perhaps, the Difficulty of attaining ſuch to be inſuperable; inaſmuch as the great Author of this Diſcovery, himſelf, had not ſhewed us any Method whereby to correct thoſe Errors which ariſe from this Inequality of Refraction; but rather diſcouraged any ſuch Attempts, by declaring, “ that “ on this Account he laid aſide his Glaſs-works,” (*Phil. Tranſ.* N°. 80.) “ and looked upon the “ Improvement of Teleſcopes, of given Lengths,

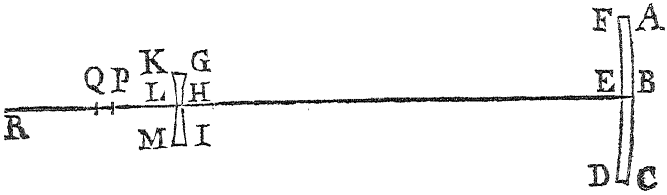
" by Refraction, as deſperate" (*Optics*, 2d Edit. *p.* 91.).

However, as it has been proved by inconteſtable Experiments, that this Diſſipation of the Rays of Light, from whatever Cauſe it proceeds, in paſſing out of one Medium into another, is not accidental and irregular; but that every ſort of homogeneal Rays, whether more or leſs refrangible, conſidered apart, are refracted according to ſome conſtant uniform and certain Law; and as the Removal of ſo great an Impediment as this of unequal Refraction in the Rays of Light, is of great Importance to the Science of Dioptrics, and abſolutely neceſſary to its further Advancement; we have thought it worthy of a careful Examination, whether, in ſome Caſes at leaſt, it might not be poſſible for contrary Refractions ſo to correct each other's Inequalities, as to make their Difference regular; and if this could be conveniently effected, Sir *Iſaac Newton* has acknowledged, " there would be no farther Difficulty" (*Phil. Tranſ.* N°. 88).

Now, upon a due Conſideration of this Subject, we have found it poſſible, by proper Methods and Expedients, to rectify thoſe Errors which proceed from the different Degrees of Refrangibility in different Rays, paſſing from one Medium into another; admitting only this well-known and eſtabliſhed Principle, upon which we ground our Reaſoning, *viz.* " That the Sines of Refraction of Rays differently " refrangible, are one to another in a given Pro- " portion, when their Sines of Incidence are equal" (*Optics*, 2d Edit. p. 66.). And our preſent Deſign is, to ſhew what Advantage this will yield towards im-

improving and perfecting Catadioptrical Teleſcopes, by making the Speculums of Glaſs, inſtead of Metal, in the following Manner:

Fig. 1.



Let the Figure *ABCDEF* repreſent the Section of a concavo-convex Speculum, whoſe two Surfaces are Segments of unequal Spheres; call the Radius of the Sphere, to which the concave Side is ground, *a*; and the Radius of the convex Surface, which muſt be quickſilver'd over, *e*; let *BR* be the Axis of the Speculum, or a Line perpendicular to both the Surfaces; and therein let *P* be the principal Focus, or Point where parallel Rays of the moſt refrangible Kind are collected, by this Speculum; and *Q* the Focus, or Point of Concourſe, of ſuch Rays as are leaſt refrangible; to wit, after they have ſuffer'd two Refractions, at entering into, and paſſing out of, the concave Surface *DEF*, and alſo one Reflection from the convex Surface *ABC*: If the Radius of Concavity be greater than the Radius of Convexity, as we will in the firſt Place ſuppoſe, then *P* will fall nearer the Vertex of the Speculum than the Point *Q*; and the Interval *QP* will be the greateſt Aberration, or Error, occaſioned by the Separation, or unequal Refraction, of the greateſt and leaſt refrangible Rays, after their Emergence from the concave Surface *FED*. Call the common Sine of Incidence, $n$; the Sine of Refraction of the leaſt refrangible Rays out of a denſe Medium into a rarer, $m$; and, of the moſt refrangible, $\mu$; then, according to the known and received Laws of Refraction and Reflection, the Focal Diſtance of the moſt refrangible Rays, from the Vertex of the Speculum, (neglecting its Thickneſs, as of little or no Moment in the preſent Caſe) will be found $=\frac{nae}{(a-e)2\mu+2ne}=PB$. And the Quantity of the greateſt Aberration, occaſioned by the different Refrangibility of the moſt and leaſt refrangible Rays, *PQ*, will be to the focal Diſtance juſt mentioned, *PB*, as $(a-e(\times(\mu-m)$ to $(a-e)m+en$; which Quantity, or Error, thus obtained, (to abbreviate the Calculation) call $\varepsilon$; and now let it be required to form a Lens, if poſſible, which, placed at ſome given Point in the Axis between the Focus of the moſt refrangible Rays *P*, and the Vertex of the Speculum (as *H*), ſhall refract not only the Rays of the moſt refrangible Kind tending to the Point *P*, but alſo the Rays of the leaſt refrangible Kind tending to *Q*, in ſuch a Manner, that both Sorts ſhall concur, after ſuch Refraction, in ſome other Point of the Axis *R*; let *HP* the given Diſtance of the Point in the Axis *H*, from the Focal Point *P*, be called $d$; and then if the Point *H* has been aſſumed, ſo that the ſaid given Quantity, or Diſtance, $d$, is greater than $\frac{(\mu-n)\varepsilon}{\mu-m}$, but leſs than $\frac{m\varepsilon}{\mu-m}$, I ſay the refracting Superficies *GHI*, that ſhall perform what was required, will be part of a concave Sphere, whoſe Radius is $= \frac{(dd + d\varepsilon) \times (\mu - m)}{m\varepsilon - (\mu - m) d}$; and *HR*, the Diſtance of the given Point *H*, from *R*, the Point to which all the Rays will tend, after Refraction at the ſaid concave Surface, (whoſe Radius being found, as above, we call $\upsilon$) will be $= \frac{\mu d \upsilon}{(d + \upsilon) n - \mu d}$. Laſtly, upon the Point *R* thus obtained, as a Centre, with an Interval a little leſs than *HR*, deſcribe the Circumference *KLM*, and the Figure *GHIMLK* will denote the Section of a double concave Lens, which, placed at the given Point in the Axis *H*, (taken nevertheleſs within the Limits above-mentioned) will collect all Sorts of Rays proceeding from the Speculum, into one and the ſame Focus, or Point of the Axis, *R*, as was required; for the Surface *GHI*, which firſt receives thoſe Rays, will refract the moſt refrangible Sort converging to the Point *P*, and alſo the leaſt refrangible converging towards *Q*, ſo that both Sorts, after ſuch Refraction, will concur in the Point *R*; but the Rays tending to *R*, 'tis manifeſt, will ſuffer no Refraction at their Emergence from the Superficies *KLM*, becauſe *R* is the Centre thereof, by Conſtruction; which Point, *R*, where a perfect Image of an Object infinitely diſtant will be formed, we call the Focus of the Teleſcope, to diſtinguiſh it from the Point, *P*, which we have before called the Focus of the Speculum.

In this manner a Lens, (or inſtead thereof a triangular Priſm with two of its Sides ground concave, and the third plain, if that be found as practicable) may be formed and ſituated, ſo as to correct the Errors of the Speculum ariſing from the different

Refrangibility of the Rays of Light. But, in order to render this kind of Teleſcopes abſolutely perfect in their Conſtruction, the Errors alſo that reſult from the ſpherical Figure, muſt be rectified; and with regard to this, we aſſert, that it is poſſible to aſſume a Point in the Axis, between the Focus of the Speculum and its Vertex, (as we have taken the Point *H*, in the following Example, ſee Fig. 2. p. 337.) at which, if a refracting Superficies, or Lens, be conſtituted, according to the Method already delivered, it will not only correct the Errors occaſioned by the unequal Refraction of the Rays of Light, but alſo rectify ſuch as proceed from the ſpherical Figure of this Speculum, to a much greater Degree of Exactneſs than is requiſite for any Phyſical Purpoſe (meaning always the Errors of thoſe Rays which reſpect the Axis). Now to find or determine this Point, affords a Problem not eaſy to be ſolved; and we recommend it, as worthy of the Conſideration of Geometricians.

Seeing therefore it is poſſible, and we believe alſo practicable, to remedy the Imperfections of this kind of Speculums, (from whatſoever Cauſe they ariſe) by the Method we have here propoſed; it ſeems to follow, that Catadioptrical Teleſcopes may be carried, by this means, to as great a Degree of Perfection, as they are capable of receiving; provided ſpherical Figures can be truly communicated, with an exquiſite Poliſh, to Glaſſes of a large Aperture, and a Foil of Quickſilver made alſo to retain that Figure accurately, and without any Inequality; for the Object-glaſs or Speculum being rendered perfect, ſo as that all ſorts of Rays, proceeding from one lucid Point in its

Axis, ſhall be collected by means of the Lens exactly in another Point, its Aperture may then be extended to its furtheſt Limits; and that is, till the whole Pupil of the Eye (or the whole Portion of the Eye-glaſs to be uſed, when that becomes neceſſarily leſs than the Pupil) be filled with Rays proceeding from the Speculum, and flowing from one Point of the Object, but no farther; becauſe this is a Limitation made by Nature in the Structure of the Eye itſelf: And in Teleſcopes whoſe Conſtruction is ſuch as we have now deſcribed, the largeſt Aperture of the Speculum that can ever be of Uſe, will be to the Diameter of the Pupil of the Eye, very nearly, in a *Ratio* compounded of the *Ratio's* of the Focal Length of the Speculum to the Diſtance of that Focus from the Lens, and of the Diſtance of the Lens from the Focus of the Teleſcope, to Unity: That is, of *BP* to *PH*, and of *RH* to 1; which Proportion holds, whatever be the Charge or the Power of Magnifying.

But if Inquiry be made as to the Charge moſt proper and convenient, that will be determined beſt by Experience, in theſe, as well as in all other ſorts of Teleſcopes: However, on Suppoſition that one of a given Length has its Aperture and Charge rightly ordered and proportioned, the Rule for preſerving the ſame Degree of Brightneſs and Diſtinctneſs, in all others of a like Conſtruction, will be, to make the Apertures, and magnifying Powers, directly as the Focal Lengths of the Speculums; which ſhews the vaſt Advantage and Perfection of theſe Teleſcopes, above the common reflecting ones; where, according to Sir *Iſaac Newton's* Rule, the Apertures, and

Powers of Magnifying, muſt be as the Biquadrate Roots of the Cubes of their Lengths (See his *Optics*, 2d Edition, p. 97.).

It is likewiſe a conſiderable Advantage in this Conſtruction, that the Reflection from the concave Side of the Speculum will do no ſenſible Prejudice; becauſe the Image of any Object made thereby, is removed to ſo vaſt a Diſtance from the principal Image, formed by the convex Surface, as to create no manner of Confuſion or Diſturbance in the Viſion; which neceſſarily happens, in ſome Degree, from the Vicinity of thoſe Images, when the Glaſs is ground concave on one Side, and as much convex on the other; according to the Method propounded by Sir *Iſaac Newton*, in his moſt excellent Book of *Optics*.

It may be imagined, perhaps, at firſt View, that (if our Reaſoning is juſt) the Errors of refracting Teleſcopes, occaſioned by the different Refrangibility of Light, may be corrected by a like Artifice: But the Aberration of the Rays from the principal Focus is there ſo great, and bears ſo conſiderable a Proportion to the Focal Length of the Teleſcope, that the Error cannot be rectified by the Interpoſition of any Lens, until the Rays are, by a contrary Refraction, collected again at an infinite Diſtance, which renders this Expedient quite uſeleſs; however, there is no need to deſpair of accompliſhing even this, by other Methods: And, by the way, we may obſerve, if it were worth while to ſeek a Remedy for the Errors occaſioned by the ſpherical Figure of the Object-glaſs only, in Dioptrical Teleſcopes; that might be obtained by the proper Application of a ſuitable Lens, between the Focus and the Vertex of the Object-glaſs; which is much more eaſy and practicable, than the grinding of Glaſſes to Hyperbolical or Elliptical Figures.

For a further Illuſtration of what is gone before, it may be proper to exhibit the ſeveral Parts and Proportions of a Teleſcope in Numbers computed according to the Theorems already delivered; and in Practice we judge it will be moſt convenient, that the *Radii* of the Spheres to which the concave and convex Sides of the Speculum are ground, be nearly in the Ratio of 6 to 5; as in the following Example; where (ſee Fig. 2. p. 337.)

*ABCDEF*, repreſents the great Speculum of Glaſs, ground concave on one Side, and convex on the other; quickſilver'd over the convex Side, and of an equal Thickneſs all round its Circumference.

The *Radius* of Concavity $=a=48$ Inches.
The *Radius* of Convexity $=e=40$ Inches.

Then putting $n$, the Sine of Incidence $=100$; $m$, the Sign of Refraction of the leaſt refrangible Rays, out of Glaſs into Air, $=154$; and $\mu$, the Sine of Refraction of the moſt refrangible Rays, $=156$; as Sir *Iſaac Newton* found them by Experiments; we ſhall have,

*PB*, the Focal Length of the Speculum with regard to the moſt refrangible Rays $=18.2926+$, which will be ſomewhat increaſed by the Thickneſs of the Glaſs, when that is conſiderable.

*PQ*, the greateſt Aberration of the Rays, occaſioned by their different Degrees of Refrangibility, $=.05594+$, which Quantity, in Practice, ſhould be a very little augmented, rather than otherwiſe; wherefore we put it here $= .056 = \varepsilon$.

The *Radius* of the concave Surface of the Lens, turn'd towards the Speculum, *viz.* of *GHI*, $= \upsilon = 2.8$ Inches.

The *Radius* of the concave Surface of the Lens, turn'd from the Speculum, *viz.* of *KLM*, $= 6.7$ Inches.

The Thickneſs of the Lens at the Vertex $LH = \frac{1}{10}$ of an Inch.

The Aperture of the Lens muſt be about $\frac{1}{6}$ of the Aperture of the Speculum.

*HP*, the Diſtance of the Focal Point *P* from the Point *H*, where the abovesaid Lens is to be placed, ſo as to correct the Errors ariſing from the different Refrangibility of the Rays, and alſo the Errors of the ſpherical Figure, $= 2.\frac{24}{73}$ Inches.

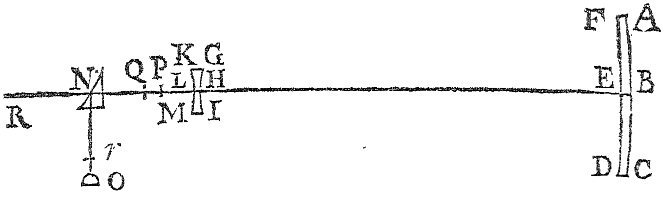
*HR*, the Diſtance of *H* the Vertex of the Lens from *R* the Focus of the Teleſcope, $= 6.8$ Inches.

And if we ſuppoſe the Diameter of the Pupil of the Eye to be $^{1}$ of an Inch, (though it has not one certain Meaſure) then the Diameter of the greateſt Aperture of the Speculum, that can ever be of Uſe, will be $6\frac{2}{3}$ Inches, nearly.

The ſmall plano-convex Eye-glaſs *O* muſt always have one common Focus with the Teleſcope, to wit, the Point *R* tranſlated to *r*, by Reflection from the Baſe of the Priſm *N*; for which Reaſon it muſt retain, at all times, an equal and invariable Diſtance from the Lens *GHIKLM*; which Diſtance will be the Focal Length of the ſaid Eye-Glaſs more *HR* $(= HN + Nr)$ the Diſtance of the Lens from the Focus of the Teleſcope *R*.

The

Fig. 2.



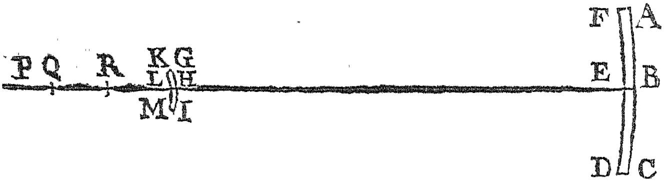
The Form and Poſition of the Priſm *N*, and the Contrivance of the other Parts neceſſary, will be much the ſame as in the *Newtonian* Teleſcope.

If the Focal Length of the Eye-glaſs be $\frac{1}{4}$ of an Inch, the Teleſcope will magnify about 200 times.

This Teleſcope may be contrived in the *Gregorian* way, by uſing, inſtead of a Lens and Priſm, a ſmall Speculum ſpherically concave on one Side, and convex on the other; but we think it not worth while to attempt this Conſtruction, as an Inveſtigation of the Proportion between the two Surfaces neceſſary, in this ſmall Speculum, to unite the Rays proceeding from the great one, into one Point, would be intricate, and the Practice alſo very difficult; by reaſon that a little Inaccuracy will, in this Caſe, occaſion Errors much more conſiderable than a like Imperfection in the refracting Lens.

We have hitherto ſuppoſed the *Radius* of the Concavity greater than that of the Convexity; as being moſt convenient and uſeful, on ſeveral Accounts, in forming this kind of Teleſcopes; however, it may be proper to remark, that the ſame Method may be uſed for correcting the Errors of the Speculum, when the *Radius* of its Concavity is leſs than that of the Convexity; only the refracting Superficies of the Lens, placed between its Vertex and Focus, will be convex, and not concave, as in the former Caſe. And there is another thing worthy of Remark, that the Focus, or Point (*P*), where the moſt refrangible Rays are collected, will fall farther from the Vertex of this Speculum, than the Focus of the leaſt refrangible (*Q*); a Circumſtance which never happens by Refraction alone, in Glaſſes of any Figure whatſoever, or howſoever they be diſpoſed.

Fig. 3.



Now all things being put as before, and making (Fig. 3.) $HQ = d$, I ſay the convex Superficies *GHI* of a Lens placed at *H*, that ſhall correct the Errors ariſing from the different Refrangibility of Rays, in this kind of Speculum, will be part of a Sphere, whoſe *Radius* is $= \frac{(\mu - m) \times (dd + d\varepsilon)}{(\mu - m)d + n\varepsilon} = v$. And *HR*, the Diſtance of the Point *R*, where the Rays of all ſorts will unite, after this Refraction, from *H* the given Point in the Axis, will be $= \frac{\mu d v}{(\mu - n)d + nv}$; which Point *R* being taken as a Centre, deſcribe thereon the Arch *KLM*, and the Figure *GHIMLK* will repreſent the Section of a Meniſcus-glaſs, or Lens, which, placed at the Point *H*, aſſumed between the Vertex and Focus of the Speculum, will collect all ſorts of Rays proceeding therefrom into one and the ſame Point, or Focus, *R*. We might alſo ſhew, how this Error may be rectified by one or more Glaſſes, placed in the Axis, at a Diſtance farther from the Vertex than the Focal Point *P*; but the former Speculum is ſo much preferable to this, for the conſtructing of Teleſcopes, that we think it not worth while to proſecute this Matter farther. To conclude this Eſſay;

Whoever ſhall think fit to put the Method here propoſed in Execution, we dare venture (from a Trial that has been made) to aſſure him of Succeſs; provided the ſame Diligence, Care, and Accuracy, be applied, in chooſing, figuring, poliſhing and foiling, the Glaſs, that has of late been employed for the forming Speculums of Metal; and let none be diſcouraged, though the firſt and ſecond Attempt ſhould fail; for that muſt be expected, if the ordinary way of grinding and poliſhing be uſed: Greater Exactneſs is here required, than is uſually thought ſufficient for the Object-glaſſes of refracting Teleſcopes: Let it be alſo conſidered how many Eſſays, for a long Term of Years, were made by Mr. *Gregory*, Sir *Iſaac Newton*, and others, to reduce their Conſtructions of the reflecting Teleſcope into Practice, without anſwering, in any tolerable Degree, what their Theories promiſed: The Workmen they employed were chiefly Optical Inſtrument-makers, and had it been left to ſuch Perſons only to perform by themſelves, we have reaſon to think, that it would have been pronounced impracticable to this Day, to make a reflecting Teleſcope that ſhould equal or excel refracting ones of Ten times its Length; though we now ſee, that moſt of theſe Artificers are capable of making them to ſuch a Degree of Perfection as was formerly deſpaired of.

*April* 5. 1739.

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## IX. *Extract of a Letter from the Hon*$^{ble}$ Henry Temple, *Eſq*; *to his Father the Right Hon*$^{ble}$ *the Lord Viſcount* Palmerſton, *concerning an* Earthquake *at* Naples; *communicated to the* Royal Society *by* Claudius Amyand, *Eſq*; F.R.S. *and Sergeant Surgeon to His* MAJESTY.

*Naples*, *Dec.* 12. *N. S.* 1732.

—THEY tell me, the laſt Earthquake here has made a great Crack in the Side of Mount *Veſuvius*, above 30 Yards long. I am not ſure if this be true or not, though I think it very poſſible; but I made another Obſervation upon it, which I think much more extraordinary; which is, that the ſecond Shock, which was a very ſlight one, had a great Effect upon the Nerves: I and all the Company where I was, as ſoon as the Shock was over, were ſeized with a Shaking, juſt as if we all had the Palſy, our Teeth chattering in our Heads to ſuch a degree, that we could hardly ſpeak; and I find, that half the Town felt the ſame Effect from it. It would be natural to imagine, that this Shaking was cauſed by the Fright, but it is eaſy to prove the contrary; becauſe, in the firſt place, the firſt Shock, which was much more terrifying, had not that Effect:

Secondly, many People who were not ſenſible of the Earthquake, found themſelves ſeized in the ſame Manner: Thirdly, Mr.——who uſed to be troubled with convulſive Fits, and had got quite cured of them here, was immediately ſeized with them again, after the Earthquake; and, Fourthly, every body, more or leſs, complained of Head-achs for ſome Days after.

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## X. *A Letter from Mr.* Timothy Sheldrake *to Sir* Hans Sloane, *Bart.* *Pr.* R. S. *&c. concerning a* Monſtrous Child *born of a Woman under Sentence of Tranſportation.*

*SIR*, *Norwich, Jan.* 8. 1734-5.

I Herewith ſend you both a Draught and Deſcription of a monſtrous Birth, which I believe the Royal Society have had as yet no Account of; which gives me Hopes, that what I here ſend will prove the more acceptable to you.

*Elizabeth Spencer*, being tried at our Aſſizes for the City and County of *Norwich*, for Shop-lifting, and being found guilty of the Crime, received Sentence for Tranſportation; for reſpiting of which Sentence ſhe pleaded her Belly, which Plea, as ſhe was a married Woman, appearing what was very probable, ſhe was favour'd by the Mayor and the other Magiſtrates, by being allowed the full Time that ſhe ſaid ſhe had to go; at the Expiration of which ſhe was delivered of a Child, which I ſaw a few Hours after it was born, and was exactly, in every Part, according to the following Account, and as I have here delineated it [*See* TAB. II. Fig. 2.]. The Head had a Riſing on the Top of it, and the Noſe was as if one Noſe was on the Top of another, but only two Noſtrils, and thoſe at the Bottom of the lower Noſe. The Arms were without the Elbow-Joint; the two Bones, which make the lower Joint of the Arm, in common, were in this extended to the Shoulder. Juſt under the Ribs, and above the Hips, was a deep Place, as if a Cord had been tied very ſtreight, ſo as to ſink down below the Reach of the Eye: This girding-in of the Body, I believe might go almoſt round: I did not turn it, to ſee whether it did or not, but it was continued as far about the Body as I could ſee, without turning it. By this girding-in of the Body, the lower Part of it was almoſt round, it being without either Legs or Thighs; but had two Feet joined unto the lower Part of the Body, the Heels inward, the Toes (of which it had not the full Number) pointing towards the Sides, as is deſcribed in the Drawing here incloſed. As to Sex, this Creature was a Female, and born alive. It was the Opinion of the Women about her, that the Midwife had injured the Head in the Birth, by which the Riſing in the Head was produced; and this ſurpriſing Creature that was born alive, was thereby ſoon deprived thereof. This Woman, who had been the Mother of ſeveral Children, before this ſtrange Production, and all in perfect Form, was by ſome free-ſpeaking Perſons charged with having been guilty of ſome Practices both unnatural and unlawful, which ſhe very poſitively always denied; and ſaid that ſhe knew nothing that could give any Change to the natural Form of this Creature, but the ſtrange Apprehenſions that her Sentence had put her under, from the uncommon Creatures the Country to which ſhe was ſentenced might bring in her Sight. Theſe odd Ideas that ſhe had formed to herſelf, was all and the only thing, that had occaſioned ſo great a Change from the natural Form the Child might otherwiſe have had, as ſhe often aſſerted. I am,

*SIR,*

*Your very humble Servant,*

Tim. Sheldrake.

### XI. *A Paper concerning the* Mola Salu. *or* Sun-fiſh, *and a* Glue *made of it; communicated by the Rev. Mr.* William Barlow *to the* Preſident *of the* Royal Society.

*Stoke-Dock* near *Plymouth, Devon,*
*June* 29. 1734.

THERE was brought to this Place, ſtruck the Day before in our River, a *Sun-fiſh* weighing about 500 Pound Weight. The Form of it nearly anſwers that given by Mr. *Willoughby*, except that the Tail of this was ſcollop'd.

This Fiſh differed very much in one thing from that deſcribed by Mr. *Willoughby*, whoſe Fleſh, he ſays, was very ſoft: On the contrary, the Fleſh of this was hard and firm, rather a griſtly Subſtance than ſoft Fleſh.

A Gentleman of my Acquaintance, Commander of a Veſſel, tells me, his People took a *Sun-fiſh*, South of *Newfoundland*, which, by his Deſcription, was conſiderably larger than that brought hither. They made no Uſe of the Fleſh; but he remembers it was a griſtly Subſtance, hard and firm.

A Piece of the Fleſh boiled, to try how it would look and taſte, to our Surprize, was all turned into a Jelly. Being ſoft and tender, it could not be taken out of the Saucepan with a Fork, but only with a Spoon; in Colour and Conſiſtence nearly reſembling boiled Starch when cold. It had little or nothing of the Fiſhy, but a grateful and pleaſant Taſte.

By the ſticking together of my Lips, and from what I obſerved by touching it with my Fingers, I took Notice, that this boiled Fleſh was clammy and glutinous; which brought to my Mind, that what the Antients made uſe of to ſerve the Purpoſes of Glue, was made from Fiſh. I then tried it upon Paper and Leather, and found it to anſwer the Uſe of Paſte very well: And it was owing in part to Neglect, and partly to Accident, that it was not alſo tried upon Wood.

From this Diſcovery of the glutinous Nature of the Fleſh of the *Sun-fiſh*, I would recommend it to thoſe who have Opportunity to make farther Experiments upon it; and probably ſomething uſeful, or curious at leaſt, may be a ſatisfactory Reward for the Trouble they ſhall give themſelves on that Account.

From the Deſcriptions given us of the *Ichthyocolla* by *Dioſcorides* and *Pliny*, the Glue-fiſh ſeems not to be the ſame as our *Sun-fiſh*. Whether the Fiſh from which our Iſinglaſs is made, be the ſame as the *Ichthyocolla* of the forementioned Authors, as the Name uſually given to it ſeems to import, I cannot tell: But neither the *Ichthyocolla* of *Rondelitius* or *Bellonius*, nor the *Huſo* taken in the *Danube*, from the Bladder of which Fiſh-glue is made, can, by the Deſcriptions given of them, be the ſame as the *Sun-fiſh*.

## XII. *An Account of the Diſcovery of the* Remains *of a* City *under-ground, near* Naples; *communicated to the* ROYAL SOCIETY *by* William Sloane, *Eſq*; F. R. S.

AT *Reſina*, about four Miles from *Naples*, under the Mountain, within half a Mile of the Sea-ſide, there is a Well in a poor Man's Yard, down which about 30 Yards there is a Hole, which ſome People have the Curioſity to creep into, and may afterwards creep a good way under-ground, and with Lights find Foundations of Houſes and Streets, which, by ſome it is ſaid, was in the Time of the *Romans* a City called *Aretina*, others ſay *Port Hercules*, where the *Romans* uſually embarked from for *Africa*. I have ſeen the Well, which is deep, and a good Depth of Water at the Bottom, that I never cared to venture down, being heavy, and the Ropes bad. This City, it is thought, was overwhelmed by an

Eruption of the Mountain *Veſuvius*, not ſunk by Earthquakes, as were *Cuma*, *Baia*, *Trepergola*, &c.

*Naples*, *March* 7. 1731-2.

Signed,

*William Hammond.*

*SIR*,

In purſuance to your Deſire, the above Account is tranſmitted me by my Partner, about the City you mentioned under-ground near *Naples*.

*I am very reſpectfully*,

*SIR*,

*Your moſt humble Servant*,

John Green.

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## XIII. *An Account of a* Meteor *ſeen in the Air in the Day-time, on* Dec. 8. 1733; *communicated by Mr.* Crocker *to Sir* Hans Sloane, *Bart. Pr.* R. S. *&c.*

*SIR*, *Fleet*, *Dorſetſhire*, *Dec.* 23. 1733.

ON *Saturday* the 8th of this Inſtant, the Sun ſhining bright, the Weather warm, and Wind at South-Eaſt, ſome ſmall Clouds paſſing, I ſaw ſomething (between Eleven and Twelve) in the Sky, which reſembled a Boy's Paper Kite, which appeared towards the North, and ſoon vaniſhed from my Sight, being intercepted by the Trees which were near the Valley where I was ſtanding. The Colour of it was of a pale Brightneſs, like that of burniſhed or new-waſhed Silver. It darted out of my Sight with a ſeeming Coruſcation, like that of Star-ſhooting in the Night; but had a Body much larger, and a Train much longer, than any thing of that Kind I had ever ſeen before. At my coming home, one *Brown* aſſured me, he had ſeen the ſame thing, for the Continuance of a Minute; and that the Body and Train appeared to him to be about twenty Foot long, and ſeemed to him to fall to the Ground ſomewhere about the Kennel-garden, whither I accompanied him in Expectation of finding ſome of thoſe Jellies which are ſuppoſed to owe their Beings to ſuch Meteors: But we might have ſearched long enough, as I underſtood the next Day, when Mr. *Edgcombe* informed me, that he and another Gentleman had ſeen the ſame Appearance at the ſame time about fifteen Miles from us, ſteering the ſame Courſe from Eaſt to the Weſt, and vaniſhed from them between *Walkhampton* and *Oakhampton*: They gave the ſame Account of its Figure, Length and Colour.

## XIV. *An Account of a* Luminous Appearance *in the Sky, ſeen at* London *on* Thurſday March 13. 1734-5. *by* John Bevis, *M. D.*

AS I was obſerving *Mars* near a ſmall fixt Star, then in the Weſt, on the Top of my Houſe in *Buckingham-ſtreet*, about five Minutes after Eight, equal Time; happening to turn my Face Southward, I was ſurpriſed with an uncommon bright Glade of

Light. It was ſtrait, about 2½ Degrees broad, and 110, or 120 Degrees long, ill defined at either End, but pretty well at the Sides, that is, much as the common Rainbow, or one of thoſe Pyramids which are uſed to dart up from the Horizon in an *Aurora Borealis*, which Light it reſembled in all reſpects, except in its Place and Poſition, and that this was ſteady, and altogether without that tremulous kind of Motion, which uſually accompanies that. Beſides *Saturn*, *Mars*, *Venus*, and the fixt Stars, there was then no other Light in the Sky, nor the leaſt Cloud, nor any of that horizontal Blackneſs which we ſee Northward in the *Aurora*. The Stars were as diſcernible through it, as if nothing had been there. A Gentleman who was with me, fanſied it to be the Tail of a Comet; but as neither he nor myſelf had ever ſeen one, I gave but little Heed to that Conjecture: However, I carefully directed a 17 Foot Glaſs to all Parts of its weſtern Extremity, but could diſcern nothing like a *Nucleus*. When I firſt ſaw it, it extended itſelf from about the Mid-way between *Aldebaran*, and *Orion*'s Left Shoulder, through *Gemini* a little under β, and ſo on through *Cancer* and *Leo*, juſt above *Cauda Leonis*, till it arrived between *Vindematrix* and *Coma Berenices*, where it ended very dilutedly. In about half an Hour it grew dim about the Middle, where in a ſhort time it ſeparated in two, or rather became quite dark there; but then methought the disjoined Parts were more luminous than before; but they too in a little while after grew dimmer, and ſhortened away, on to their remote Extremities, which remained viſible the longeſt; the Weſtern one about Nine o'Clock, the

Time of its Extinction, being near *Orion's* Right Shoulder, and the other near the Left Knee of *Boötes*; ſo that this Meteor ſeems pretty nearly to have accompanied the Earth in its diurnal Motion, and to have had little or no Motion beſides. I have looked for this Light ſince, but could find nothing like it.

The Day was exceeding fine, and by my Journal I find, that,

| | | |
|---|---|---|
| At Noon, the | Barometer was | 29.98. |
| | Thermometer | 57. |
| | Wind . . . . | Eaſt. |
| | Decl. of the Needle | 14° 10. |
| At 10 at Night, | Barometer | 29.86. |
| | Thermometer | 57.5. |
| | Decl. of the Needle | 13° 50'. |

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## XV. *An Account of the Caſe of a* Calculus *making its Way through an old* Cicatrix *in the* Perinæum, *by* David Hartley, *M. A.* F. R. S.

*Jan.* 12. 1740.

*William Jarman*, of the Pariſh of *Bayton* in *Suffolk*, was cut for the Stone about 15 Years ago, and a large Stone taken from him.

The ſaid *William Jarman* ſays, that he continued eaſy for about four Years after he was cut; that the Wound was quite healed up, and that he made Water in the natural Way, without any Leakage at the Wound.

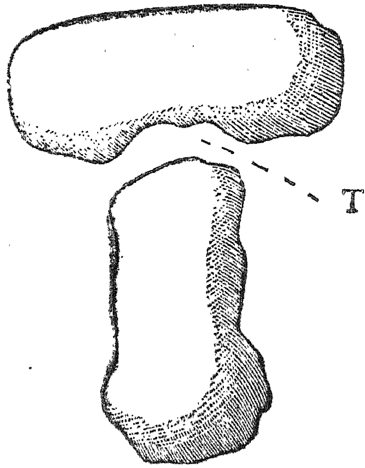
In *July* laſt, he ſays, he felt great Pain at the Place where he was cut, and that it was much ſwelled.

It looked black, and a little Hole broke open there; out of which the Water came; and a Stone appearing, the Hole grew wider by the Force of the Water, and his frequently touching it, till at laſt the Stone came away whole. It was broken afterwards by a Fall.

As ſoon as the Stone was come away he ſays that he grew eaſy, and the Swelling abated. The Wound is now reduced to a ſmall Compaſs, and the Water ſtill comes away through the Wound, and but very little Water comes out the natural Way.

*William Jarman* is about 30 Years of Age. He ſays, that the great End of the Stone came away firſt, which he ſuffered to lie at the Mouth of the Wound near a Fortnight, but he applied to no Surgeon.

## *An* Addition *by the* Publiſher *to the foregoing Caſe.*



There they articulated or rubbed againſt each other, while in the Bladder; one having a round Head, the other a Cavity.

Figures of Stones which made their Way through the *Perinæum* of a Man at *Leyden*, *Anno* 1724. ſeen there by *C. Mortimer*.

## XVI. *An Account of a Stone, or* Calculus, *making its Way out through the* Scrotum; *communicated by Mr.* John Siſley, *Surgeon, to Sir* Hans Sloane, *Bart. Pr.* R. S. *&c.*

ONE *Robert Swann*, of *Eaſt-Malling*, *Kent*, a hard working Man in the Woods, ſent for me one Day to ſee him. When I came to him, I found him with a large Swelling on his *Teſticles*; on the upper Part of the *Scrotum*, I found a ſmall Hole or two, and he told me, his Urine ouſed out ſometimes. I paſſed the Probe in, and found a hard Subſtance, which ſeemed to be large: I told him, he had a large Stone lodged there, at which the poor Man was much ſurpriſed. I told him, I would make Inciſion and take it out; he refuſed to be cut. I dilated it in another Manner, made the Orifice pretty large: The Swelling of his *Teſticles* aſſwaged, he goes to work, as uſual; about a Week's time after, coming home at Night with a large Bundle of Wood at his Back, found himſelf more in Pain than ordinary; as ſoon as he got home, complained to his Wife, and told her he was very much in Pain, went to-bed, deſired me to be ſent for immediately; but before I could get to him, the Stone forced its Way out; and as ſoon as I came to him, the poor Man ſeemed much rejoiced, and told me, (as he expreſſed himſelf) the *Swan* had laid an Egg: Its Weight at firſt was ℥v and ʒij, now almoſt four Ounces and three Quarters. This Man lived about ſeven Years after this, in a good State of Health, and lived to the Age of Threeſcore or upwards. He told me, he believed the Stone had been growing there for near thirty Years; but never apprehended it to be a Stone, but uſed to complain of a Weight, as if it were half a Pound, carried between his Legs.

*John Siſley,*
Surgeon and Apothecary,
*Town-Malling, Kent.*

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## XVII. *A Letter from Mr.* Moreton Gilks, F.R.S. *to Dr.* Mortimer, *Sec.* R.S. *giving ſome Account of the* Petrefactions *near* Matlock Baths *in* Derbyſhire; *with his Conjectures concerning Petrefaction in General.*

*SIR,*

IN the mountainous Part of *Derbyſhire,* about *Cromford,* is a Valley of at leaſt a Mile and half long, walled on each Side with high craggy Rocks; the Eaſt Side cliffy, the Weſt more reclining, but extremely rough and difficult of Aſcent; being compoſed of large looſe Pieces of the Lime-ſtone Rock, of five, ten, or twenty Ton Weight; that ſeem at ſome Diſtance of Time to have broken off from the Top of the Cliffs, and fallen down into the Valleys.—— At the Bottom of the Valley, which ſeems to be a great gaping Fiſſure of the Rock, runs the River *Derwent* harſhly along its rocky Bottom. About the Middle of the Valley, at near 50 Foot perpendicular Height from the River, iſſue forth ſeveral Ri-

Rivulets of a luke-warm Water, that pour themſelves into the *Derwent* below. Some of this Water, being collected in a Reſervoir, on account of its agreeable Warmth, hath of late Years been much uſed for batheing, and is called *Matlock Bath*. Now for about the Compaſs of 500 or 600 Yards, near to where this Water guſhes out, the Stone appears of a very different Texture and Complexion; and proves, upon Examination, to be a perfect Incruſtation, formed upon the original Rock; compoſing a factitious Stone, of Earth, Vegetables, *&c.* of various Kinds, ſuch as uſually grow in rocky Places, as Polypody, Tricomanes, and other Species of the capillary Tribe, Moſſes, Brambles, Ivy, Hazle, *&c.*—— There are ſeveral large Grotto's at about 15 Foot above the Level of the River, lined moſt curiouſly with the *Stalactitæ*, *Lapides Stillatitii*, &c. Some of them nearly reſemble large Bunches of Grapes, and other Cluſters of Fruit, very beautiful to look upon. Specimens of moſt of them I think I have ſent.——I found upon Examination, that the farther you penetrate into this Mountain, the cloſer and more compact the Stone appears; the Interſtices in the petrified Matter being at the Depth of 15 or 16 Foot, almoſt filled up, and nearly as ſolid as the Lime-ſtone, of which the original Rock is compoſed; and even within four or five Foot of the Surface, though very open and porous; yet is it ſo hard as to be uſed in the Building about the Bath; and I imagine it may be equally durable, though eaſier to work with the Saw, than the cloſe Lime-ſtone.

The Mountain in ſeveral Places jets out almoſt over the Brink of the River; under theſe Protuberances are the Grotto's, very dangerous and difficult to get at. It was here the Specimens I ſend you were collected †, but it is impoſſible to give you an Idea of the natural Beauty of the Place. The Froſt-work, and incruſted Plants, are ſome of them ſo very delicate and tender, as to make it impracticable to bring them away with half their Beauty, by the moſt careful Conveyance. In one Place there is an Ivy creeping along the Rock, part of it intirely petrified, another part only incruſted, and a third ſtill vegetating. In another Place is a Hazle-tree, the Root whereof compoſes a Part of this petrified Mountain, the Branches ſome petrified, and ſome tenderly incruſted. As theſe are changed, others ſpring up, and in Time will undergo the ſame Fate. In ſhort, nothing in Nature can give a more clear Idea, or more beautiful Repreſentation, of the whole Buſineſs of Petrefaction, than a curious Obſerver will ſee, and frame in his Mind from this Mountain. He will ſee, that not only the Water, as it diſtils out of the Rocks, is capable of incruſting and petrifying the Bodies it meets with in its Paſſage, but that even the Steams and Exhalations *, being highly ſaturated with theſe mineral Particles, will work the ſame Effect; as is evident in the Place under Conſideration, and will generally beſt account for the Supply of petrifying Matter, brought to fill up the Vacuities that are left by the Decay and Waſte of Vegetables incruſted over; and which, he will ſee, are in Courſe of Time conſtantly filled therewith. For although the Water of ſome

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† They are depoſited in the *Muſeum* of the ROYAL SOCIETY.
* Vide *Woodward's* Natural Hiſtory, *p.* 136. 209.

Springs may be ſo loaded with mineral Matter, as, perhaps by penetrating the Pores of Wood and other lax Bodies, to increaſe greatly their ſpecific Gravities; yet ſurely it is contrary to the Laws of Matter, and abſurd to ſay, there is any hidden Property in ſuch Waters capable of changing the Parts of one Body into another Body ſpecifically different. It may in time, no doubt, loſe its Texture and Coherency, by the Admittance of heterogeneous Particles of different Attractions; but the Cauſe of Coherency in the Parts of the original Body muſt intirely ceaſe, and be diſſolved, before it can be ſaid to become a Part of any other Body whatever. Afterwards, indeed, the Space that was poſſeſſed by the Parts of the original Body, may be ſupplied by thoſe of the new one, ſo as to make in time a uniform Stone in the Shape of the original Plant: But if this petrified Plant be ſtill kept in the Place where the ſame petrifying Quality continues to act upon it, it will loſe even that Shape, and become a Part of the Body it is contiguous to; and ſo a great many of theſe petrified Plants, and other Bodies united together, will compoſe large Maſſes and whole *Strata* of Stone. This is clearly the Caſe in the Inſtance now before us, and perhaps it might be carried ſo far as to ſtrengthen our Conception about the general Formation of the *Strata* of Lime-ſtone or Marble; that appearing to be every-where, (notwithſtanding Dr. *Woodward* diſpatches them much more expeditiouſly *) but eſpecially in the *Peak* of *Derbyſhire*, ſuch a Petrefaction as I have been deſcribing, quite finiſhed. I could urge many Reaſons for my Suppoſition, but I will not trouble you with them here, the Compaſs of this Letter not permitting me; nor do I know how far ſuch Conjectures are capable of being uſed, with regard to the received Opinion of the World's Age; but if we had as good Authority to ſuppoſe it 60,000 Years old, as we have 6000, it would be worth the while to trace the Origin and Source of theſe petrifying Exhalations a little deeper than ſeems to have been done by Dr. *Woodward*; and might either perfect his Hiſtory, or produce a more rational Syſtem of the Earth than has yet appeared.

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* *Woodward*'s Natural Hiſtory, Part II Conſ. 4.

You will find, amongſt the things I ſend, ſome Land-coral found in a Lime-pit, where is a great Quantity of it, between Two *Strata* of Lime-ſtone of at leaſt Three Foot thick. You will find alſo ſome few Pieces of *Pſeudo-ſapphirus*, and other kinds of Spar; they are ſuch as I picked out of the Fiſſures of the Rocks I have been deſcribing. There is a vaſt Variety of theſe things in the *Peak*, much greater than hath been taken Notice of by any one; as I ſhall convince the ROYAL SOCIETY, when I am able to preſent them with a complete Collection of *Derbyſhire* Foſſils, in which I have already made ſome Progreſs: Who am,

*SIR,*

*Burton*, *Nov.* 26. 1735.

*Your moſt humble Servant,*

Moreton Gilks.

XVIII. *Part*

## XVIII. *Part of a Letter from the Abbe* Pluche *to Dr.* Mortimer, *Sec.* R. S. *concerning the* Smut *of* Corn. *Tranſlated from the* French *by* T. S. *M. D.* F. R. S.

*SIR,* *Paris, Oct.* 24. 1736. *N. S.*

I Have lately paſſed ſome Months in the Country, where I have had the Satisfaction to read in the great Book (Nature), which far exceeds all our Libraries; and I made ſeveral ſmall Obſervations, among which are the following:

1. Having with the Aſſiſtance of the Microſcope viewed the *Smut* of *Corn*, I obſerved the Stalks were all ſpotted and pricked with ſmall Burnings: Now as the *Smut* happens after a fine Rain followed by a bright Sun-ſhine, the Cauſe of this Evil is, that the Focus of thoſe very ſmall Drops is juſt near them, and on the Stalk that ſupports them: Wherefore the Sun's Rays, collected in this Point, muſt there burn; which dries up the Stalk, and prevents the Ear from graining.

The ſecond Remark is on the Corn that grows up into Ears, the Grains of which are for the moſt part full of Meal quite black. With the Microſcope I ſaw, all round or above theſe black Grains, ſmall long Bodies, rolled up, and having each a Pedicle; which I found to be the Flowers, that could not reach their due Form, or come forth and ripen; ſo that the Grain, being deprived of this Help, could not develop its Germ, and produced only a black Meal, for want of the unfolding of certain Veſſels.

The

The third Remark is, the Reaſon that invites *Thruſhes* or *Starlings* under the Legs of black Cattle grazing in a Paſture. Not being able to get near them, I obſerved them at a Diſtance with a good Glaſs. I ſaw all theſe Birds thruſt their Head and half their Body down into the Graſs, in ſuch manner that their Tails remained erect in the Air, as that of a *Duck* upon diving; which makes me think, that thoſe Birds ſeek after Worms in the Earth; and that they gather about the Cattle, becauſe as they are large Animals, upon trampling on the Ground, they oblige ſuch Worms to come forth, as happen to be preſs'd under the Weight of their Hoofs.——I ſhall be glad of every Opportunity of convincing you how much I reſpect you, and am,

*Your moſt humble,*
*and moſt obedient Servant,*

Pluche.

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## XIX. *A Letter from* John Bartram, *M. D. to* Peter Collinſon, F. R. S. *concerning a Cluſter of* ſmall Teeth *obſerved by him at the Root of each* Fang *or* great Tooth *in the Head of a* Rattle-Snake, *upon diſſecting it.*

*Mr.* Collinſon, *Philadelphia, July* 17. 1734.

NEAR *German-town,* about ſix Miles from this City, we found a *Rattle-ſnake,* which is now become a Rarity ſo near our Settlements. I took it home, and diſſected it: In the Head I met with what has not been obſerved before by any, that I can remember —— that is, a Cluſter of Teeth on each Side the upper Jaw, at the Root of the great Fangs, through which the Poiſon is ejected. —— I obſerved, in the ſame Caſe, that the two main Teeth were ſheathed in, lay four others at the Root of each Tooth, in a Cluſter together, of the ſame Shape and Figure with the great ones —— and I am apt to think for the ſame Uſe and Purpoſes, if by Accident the main Teeth happen to be broken —— as was the Fellow to this that I ſend you. —— May not theſe Cluſter of Teeth be placed to ſupply ſuch a Defect ſucceſſively —— for the Support and Defence of this Creature?

I am not certain whether this is an uncommon Caſe; perhaps others have not diſſected the Head of this Animal with the Care that I have done.——

*I am yours,*

John Bartram.

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## XX. *Notices of ſome* Meteors *obſerved at* Philadelphia *in* North-America *by* Joſeph Breintnall, *extracted out of a Letter from him to* Peter Collinſon, F. R. S.

*Philadelphia, May* 9. 1738.

THE remarkable *Aurora Borealis*, that was ſeen in *Europe* the Beginning of laſt *December*, was not ſeen here.

But we had a viſible *Aurora Borealis* the 29th of *December* 1736. The Day was clear, with a briſk cold Wind North-weſt, the Evening calm and ſerene, and about Seven we had a red *Aurora Borealis.*

On the 19th of *November* 1737. about Sun-ſet, many People in this Town ſaw a fiery *Meteor* in the Air, large and bright; it ſeemed in the *Zenith*, and ſo it ſeemed to them ſome Miles from Town; it was obſerved to be higher than the lower Clouds.

On the 7th of *December* 1737. a Minute or Two before Eleven at Night, we had two Shocks of an Earthquake, greater than ever felt here before. The ſecond Evening after, and for ſeveral Evenings in this Month, a red Vapour appeared to the Southward and South-weſtward, like the *Aurora Borealis.*

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## XXI. *A Deſcription of the Cave of* Kilcorny *in the Barony of* Burren *in* Ireland, *contained in a Letter from Mr.* Charles Lucas, *Apothecary at* Dublin, *to Sir* Hans Sloane, *Bart. Pr.* R. S. *&c.*

*SIR,*

BEFORE I give a particular Deſcription of this Cave, it may be proper to give a ſhort Sketch of that Part of the Country in which it is ſituate, being moſtly neglected, or deemed unworthy of the Notice or Obſervation of any Hiſtorian hitherto.

That Part of *Ireland* called *Burren*, is a ſmall Barony in the North-weſt Part of the County of *Clare*,

*Clare*, and bounded on the North Side by the Bay of *Galway*. It is from one End to the other a Continuation of very high, rocky, Lime ſtone Hills, there being little or no plain Land throughout the Whole. It is that Part of which it is reported, that *Oliver Cromwell* ſaid, (when he came to ſtorm a few Caſtles in it) That he could neither ſee Water enough to drown a Man, Wood enough to hang a Man, or Earth enough to bury a Man in: Notwithſtanding it is moſt fertile, and produces immenſe Quantities of Juniper, and ſome Yew; beſides great Variety of the Capillary Herbs, *Virga Aurea*, *Verbena*, and ſome other common Plants, I have found the *Teucrium Alpinum magno flore*, of *Caſpar Bauhin*, and a large ſhrubby *Cinquefoil*, anſwering the Deſcription Mr. *Moriſon* gives, in his Second Volume of *Hiſt. Oxon.* of his *Pentaphylloides rectum fruticoſum Eboracenſe.*

The Inhabitants are but few, and they moſtly poor Cottagers, whoſe chief Stock is a Parcel of Goats. They are courteous and good-natured to Strangers, though very wild and unpoliſhed; weak, blind, ſuperſtitious Zealots to the Church of *Rome*, and (like ſome more polite People in the World) led and enſlaved by a Set of mean, ignorant and illiterate Prieſts.

The Place where this Cave lies, is called *Kilcorny*: It is a pretty low Valley, in Compariſon to the Hills that ſurround it: The Entrance is into the Eaſt End of it, (for it lies Eaſt and Weſt) about Midway. There are the Ruins of an old Church, and, a little Weſtward of it, an even Plain of about an Acre of Ground; on the North Side of which, under a ſteep rugged Cliff, lies the Cave.

The Mouth of it is level with the Plain, about Three Feet Diameter: It has been much larger, but was blocked up with Lime and Stone, which plainly appears ſtill, but to what Purpoſe is not known. Some conjecture it was an Attempt to reſtrain the great Flux of Water; but the fabulous Natives, who tell numberleſs romantic Tales of it, ſay, it is a Paſſage to the *Antipodes*; and that a Stud of fine Horſes have been ſeen coming out of it very often, to eat the Corn ſown in the Valley: They further add, that many Stratagems have been tried to catch ſome of them; but, with the Loſs of ſome Mens Lives, they could catch but one Stone-horſe, the Breed of which, being very valuable, they ſay is kept to this Day by *O Loghlen*, which with them is a kind of titular King that they pay great Reſpect to. But to return to the Cave:

When you paſs this narrow Entrance, it grows much wider and loftier. The Floor is a pretty even Rock, from Two to Four or Five Yards broad: The Sides and Top are rugged and unequal, from Six to Twelve or Fourteen Feet high.

About Forty Yards from the Door, there is a pretty deep Pit, Seven or Eight Yards over; but, when paſſed, the Floor is plain and even, as before, for about Two hundred Yards, which is the fartheſt that any one known has ventured into it: For my part, I did not paſs this Pit, but have ſeen ſeveral that did, whoſe Veracity I can depend upon. Moſt People that have gone into it, went by a Thread or Clue; others have carried a Bundle of Straw, and dropped it by the Way, to guide their Return; which ſeems altogether unneceſſary, there being no Windings or Chambers throughout of any Extent. It is all over, even in the Depth of Winter, as dry as any Place of the kind under-ground can be; and what ſeems very prodigious, is, that it often pours forth ſuch a Deluge as covers the adjacent Plain, ſometimes with above twenty Feet Depth of Water.

The Times of its overflowing are uncertain and irregular; ſometimes it does not happen above once in a Year or two, but moſt commonly Three or Four times a Year: It is ſometimes obſerved to ſucceed great Rains and Storms, though it often happens without either.

The neighbouring Inhabitants are alarmed at its Approach, by a great Noiſe, as of many falling Waters at a Diſtance; which continues for ſome Hours before, and generally all the time of the Flood.

The Water comes forth with extreme Rapidity from the Mouth of the Cave, and likewiſe from ſome ſmaller Holes in the low Ground, attended with a ſurpriſing Noiſe: It flows for a Day or two, and always returns into the ſame Cave, and partly into the ſmall Holes, from whence it was obſerved to come before, but with a more ſlow and tardy Courſe. The Water is of a putrid Quality, like ſtagnated Pond-water, inſipid as Spring-water. It always leaves a filthy muddy Scum upon the Ground it covered, which greatly enriches the Soil.

It has been known ſometimes (though rarely) to overflow and ebb in ſix or eight Hours time, but in a much leſs Quantity.

There is neither River or Lake any-where in that Part of the Country, and it is above Six Miles from the Sea. There are very near it ſeveral much lower

Valleys, in which there is no Appearance of Water, unleſs a little Rain-water collected in a Pit, in the Fiſſure of a Rock, or the like.

If there be any Queries about further Circumſtances relating to it, any way material to be asked, I ſhall be always ready to anſwer them, having ſpent a good deal of Time upon the Spot, examining of it myſelf; ſo that I can aver this whole Narrative for Truth, from my own actual Obſervations.

I thought it a pity ſo remarkable and wonderful a *Phænomenon* of Nature ſhould lie hid from the Learned; and though conſcious of my own Inſufficiency, and Incapacity of writing or ſtating the Caſe methodically, have at laſt reſolved, at all Adventures, to ſend you a true, ſimple, and naked Deſcription of it.

I have been very cautious in ſaying more than any Man may ſee there.

*SIR,*

*Your moſt obedient,*
*and faithful humble Servant.*

*Dublin,*
*Nov.* 11. 1736.

Charles Lucas.

## XXII. *The Caſe of* Grace Lowdell, *aged about Sixty Years, who had an extraordinary* Tumour *on her Thigh; communicated by* John Chandler, F. R. S. *from Mr.* Mizael Malfalguerat, *Surgeon, at* St. Edmund's-bury.

GRACE *Lowdell*, a poor old Woman of the Pariſh of *St. James*, in *Bury St. Edmund's, Suffolk*, being naturally of a groſs, fat, and relaxed Conſtitution, and conſtantly given to the drinking of ſtrong Liquors; and conſequently labouring for many Years under an ill Habit of Body, ſuch as the Rheumatiſm, which had cauſed Contraction of ſome of her Fingers, with ſome nervous Affections in her Head, often cauſing ſome little Fits of Vertigo, *&c.* And though ſhe had formerly ſome Child-bearing Weakneſs, *viz.* a *Procidentia Uteri*, yet there could not be found any other ſcrophulous Symptoms, than that ſhe obſerved, when about Thirty Years of Age, ſoon after her Delivery of a Son, a little hard Swelling on the Muſcle *Biceps*, and poſterior, inferior and external lateral Part of the Thigh, a little above the Ham, without her knowing any manifeſt Occaſion for it; which at firſt went on ſlowly, but after proceeding more quickly, and the older it grew, it ſtill came on the faſter, until it increaſed to the Bulk of near a Foot in Circumference, being ſomewhat of a globulous and a little longiſh Figure from its Baſis, which was lax, like a Peduncle, or Stalk, and about half the Circumference of the Tumour, like a Neck to the Head of a Child hanging down.

From the firſt Appearance of this Tumour to the Exciſion of it, there were more than Thirty Years: She had exceſſive Pains and Uneaſineſs in it, and at laſt its Bulk and Weight had in ſome meaſure intercepted the Nouriſhment to it, ſo that an Ulcer had affected the inferior Part of it, very putrid and ſinuous, of about Six Months ſtanding.

This Excreſcence was of the natural Colour of the Skin, and was for the moſt part of a pinquedinous Subſtance; the Centre and Baſis being an *Atheroma*, but more ſcirrhous than common.

This Excreſcence, having grown ſo big, was not contained in a manifeſt *Cyſtis*, but had ſome large Circumvolutions of Fat adherent to its common Teguments, as was obſerved after the Exciſion of it, when it was ſoon conveyed away; ſo that, through Inadvertency, we did not weigh it.

My Deſign in this Caſe was to have made a total Extirpation of this Excreſcence; but by reaſon of its lying with large Veſſels, and amongſt the Tendons of the Muſcles, I was content (as Dr. *Turner* adviſes in ſuch Caſes) " To level it, the beſt we can, by " Eſcharotics, ſtill repeated as the Sloughs throw off; " till we have conſumed as much of the Gland or " Subſtance, and gone as deep, as may be ſafely ad- " ventured; when probably ſome powerful Deſic- " cative may induce a *Cicatrix*, which may ſo tie " the Remains, as to create no farther Trouble."

This Tumour had been ſhewn to moſt of the Phyſicians and Surgeons hereabouts, ſome of no leſs Skill than Note, who ſeemed to approve of the Operation: Therefore, *July* the 7th 1735. I made a Ligature about the Baſis of it, with a Slip-knot, by which I gradually conſtringed it once or twice a Day, as the Patient could ſuffer it, without cauſing any ill Symptoms, till the 17th of the ſame Month, when ſhe was taken with ſtrong Convulſions, a ſlow Fever, Syncope, her Teeth ſet in her Head, and a Loſs of her Senſes, which laſted that whole Day, and the Night following; from which time I did no more conſtringe the Tumour, preſcribed Cordials, volatile Drops, a purging *Enema*, and a paregoric Draught at Night, which had ſo good an Effect, that by the next Day ſhe was much recovered, and came to her Senſes. The Ligature began to make a Separation in the Neck of this preternatural ſprouting Excreſcence; and on the 20th, in the Preſence only of one in the Profeſſion, having all my Apparatus before me, I extirpated the whole outward Tumour without any great *Hæmorrhage*. I was induced to uſe the Ligature, in order to prevent the too great Effuſion of Blood, which might otherwiſe happen; thinking it not very ſafe to make a Ligature of the Body of ſo large an Artery as is in the Ham, for fear of intercepting afterwards the Nouriſhment to the Leg, as happens often after the Operation of the *Aneuriſma*.

The Remains, though ſordid at firſt, by a peculiar Method of Dreſſing, and proper Applications of ſtrong Digeſtives, Deterſives, *&c.* cleanſed, and the Ulcer ſoon digeſted, the Subſtance came even to the Skin, and, *Septemver* the 21ſt, it was all perfectly cured, without any Hardneſs, or any Inconvenience to her walking, and is like to remain always ſo.

# XXIII. *An Extract of a Letter from Mr.* James Short, *of the College at* Edinburgh, *to Mr.* Richard Graham, F. R. S.

*SIR,* *Edinburgh, Nov.* 18. 1736.

I Came here on *Saturday* laſt: That Evening, about Six o'Clock, there was one of the moſt remarkable *Auroræ Boreales* that ever I ſaw. At firſt there appeared the ordinary luminous Arch, the Vertex of which was about 30° above the Horizon, and had its Centre ſomewhere in the Meridian Circle. After this was perfectly well formed, there appeared little or none of the purple and red Colours which are uſually in that Arch; but immediately there broke out, from the moſt Weſtern Extremity, a great deal of that Northern Light which formed this Arch, and, ruſhing along with Rays directed to the *Zenith*, formed another *Aurora Borealis* above the firſt, the Centre of which was to the Eaſt of the Meridian: After this was formed, there followed from the ſame Extremity, a great deal of purple and red-coloured Light, quivering and ſhaking towards the *Zenith*, with a flapping Noiſe in ruſhing along, till it formed a third *Aurora Borealis*, above the ſecond, the Centre of which was ſomewhere on the Eaſt-ſide of the Meridian. When I was pleaſing myſelf with this remarkable *Phænomenon*, looking again to the Weſtern Source of theſe Arches, I perceived, as it were, a huge Pillar of a dull red coloured Light, riſing out of the ſame Place whence the Arches took their Beginning, extending itſelf in a Direction towards the *Zenith*,

*Zenith*, till it roſe almoſt 60° high. Theſe Arches and Pillar laſted very near an Hour; the two uppermoſt Arches were continually quivering and ſhaking, and the Pillar always turning to a paler Red.

I forgot to tell you, that the Night before the *Aurora Borealis*, there was a prodigious Hurricane of Wind, which laſted till the *Saturday* Morning; but all that Day it continued to blow, though not ſo hard. The Arch from whence the Wind blew, was from the North-weſt, the ſame Quarter from whence the Arches took their Riſe. To this Day, ever ſince the Hurricane of Wind, there has been a moſt intenſe Froſt: It froze ſo hard, that in leſs than 24 Hours after it began, the Lake on the North ſide of this City was ſo ſtrong as to bear People on it. Juſt now the Wind has changed, ſo that we expect a Thaw.

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## XXIV. *A Letter from Mr.* John Freke, F.R.S. *Surgeon to* St. Bartholomew's Hoſpital *to the* ROYAL SOCIETY, *relating a Caſe of extraordinary* Exoſtoſes *on the Back of a Boy.*

*GENTLEMEN,*

I Would not have troubled you with this Account of a Caſe which came to my Inſpection Yeſterday at *St. Bartholomew's Hoſpital*, had I ever ſeen the ſame before in my Practice. I know it may be ſaid to come under the Denomination of an *Exoſtoſis*, but as all others that I have ſeen, which have been very many, aroſe upon ſome particular Parts, and have not been found to proceed from a general Diſſolution of the Bones, as this hath, I think fit to ſubmit it to your Conſideration. The Caſe is as follows: Yeſterday there came a Boy of a healthy Look, and about Fourteen Years old, to ask of us at the Hoſpital, what ſhould be done to cure him of many large Swellings on his Back, which began about Three Years ſince, and have continued to grow as large on many Parts as a Peny-loaf, particularly on the Left Side: They ariſe from all the *Vertebræ* of the Neck, and reach down to the *Os Sacrum*; they likewiſe ariſe from every Rib of his Body, and joining together in all Parts of his Back, as the Ramifications of Coral do, they make, as it were, a fixed bony Pair of Bodice. If this be found worthy your Thoughts, it will afford a Pleaſure to,

GENTLEMEN,

*Your moſt humble Servant,*

*Salisbury-Court,*
*April* 15. 1736.

John Freke.

It is to be obſerved, that he had no other Symptom of the Rickets on any Joint of his Limbs.

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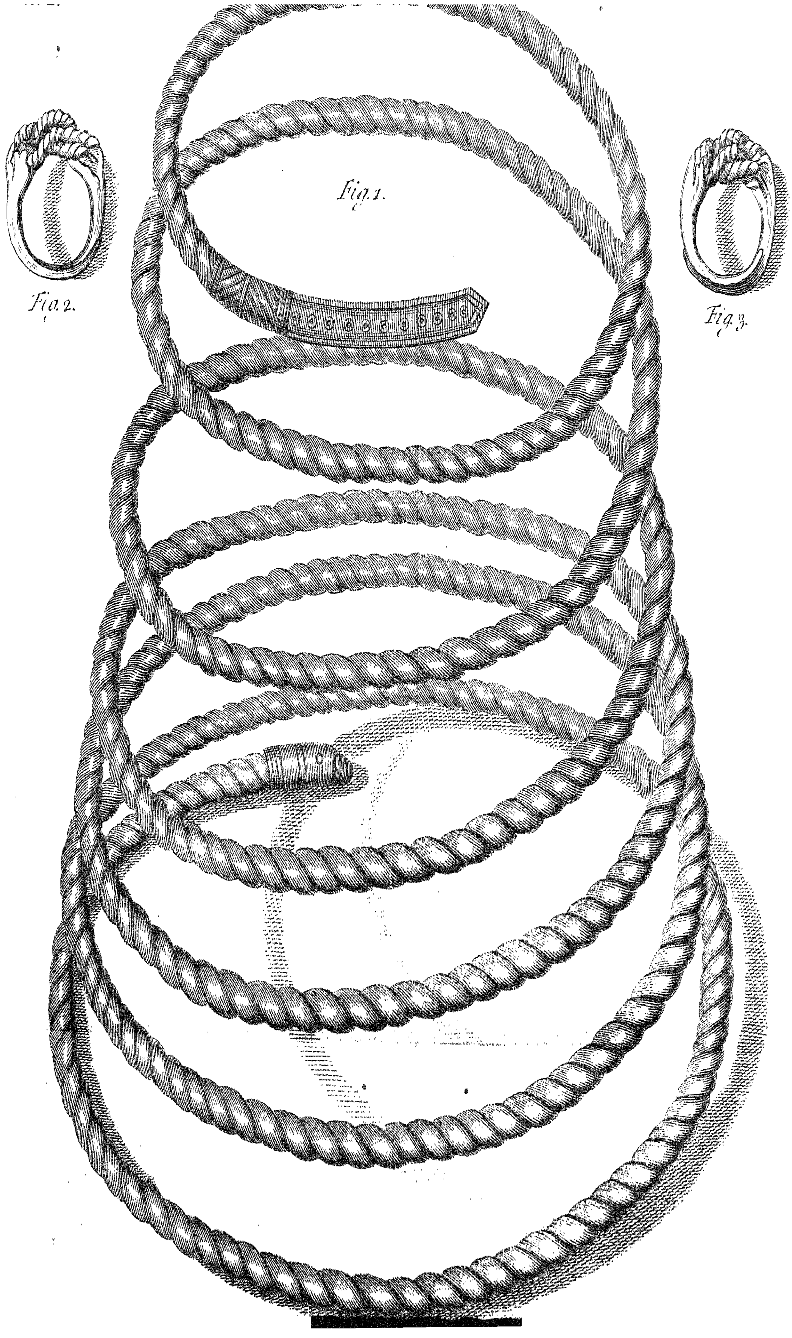

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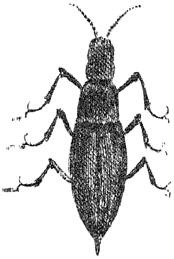
Fig. 2.

Fig. 3.

Fig. 1.



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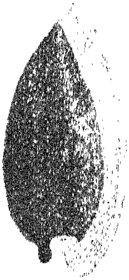

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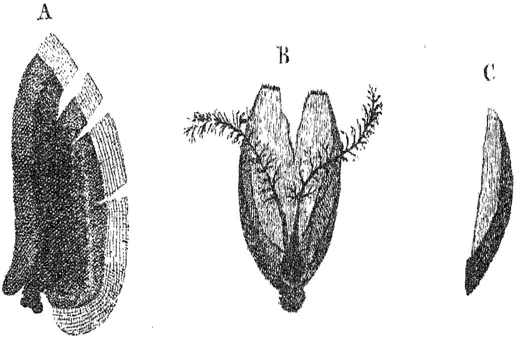

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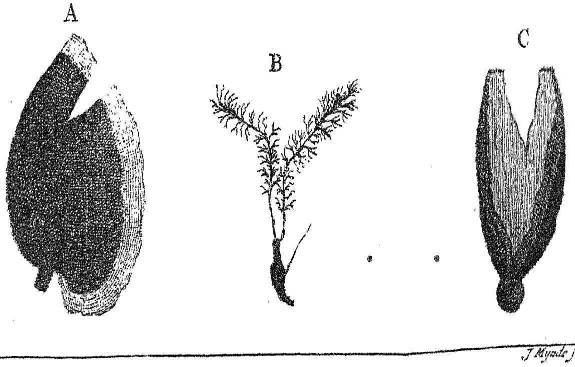

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THAT the Figure of the Earth is Spheroidical is agreed upon by all: But whether it be an oblong or oblate Spheroid, *i. e.* whether the Axis be longer or ſhorter than a Diameter at the Equator, has been for ſome time a matter of Doubt. Three ſeveral Methods have been propoſed to determine this Controverſy by Experiments; as by the different Lengths of Pendulums vibrating Seconds, in different Latitudes; the Figure of the Earth's Shadow in Lunar Eclipſes; and by the actual Meaſurement of the Lengths of a Degree on the Meridian in different Latitudes.

It is certain, if the Lengths of the Degrees of Latitude decreaſe as we go from the Equator toward the Poles, then the Axis is greater, and the Figure an oblong Spheroid; but, on the contrary, if theſe Lengths increaſe as you remove towards the Poles, the Axis is leſs than a Diameter at the Equator, and conſequently an oblate Spheroid.

Mr. *Caſſini* and others, judge the Earth to be of an oblong Spheroidical Figure; and the Obſervations made in *France*, if intirely to be depended upon, prove this *Hypotheſis* to be a Matter of Fact. Our late illuſtrious Preſident, Sir ISAAC NEWTON, Mr. *Huygens*, and others, make the Earth to be an oblate Spheroid, higher at the Equator than at the Poles; and this Figure of the Earth is undoubtedly the true one, if the Obſervations lately made near the Arctic Circle be admitted as certain and exact. So that ſince both Sets of Obſervations have been taken by Perſons of known Skill, Dexterity, and Integrity, it is now become abſolutely neceſſary to inquire into this Matter, in order to find out the Occaſion of ſo great a Difference in their Concluſions.

Mr. *Celſius*, in the Treatiſe before us, propoſes to conſider this Matter more cloſely, and begins with a Defence of the Obſervations made at *Tornea*, near the North Polar Circle; and then takes Notice of ſome things, proper to be conſidered, relating to the Inſtruments, Aſtronomical Obſervations, and Trigonometrical Operations, performed in *France*; which, in his Judgment, render the Obſervations uncertain; at leaſt ſo far as not to be accurate enough to be depended upon in determining the Matter in Queſtion.

To begin with the Defence of the Obſervations made at *Tornea*: Perhaps it may not be improper to premiſe a ſhort Account of them. They were undertaken at the Charge of the King of *France*, by Five ſkilful Gentlemen; Three of them Members of the *Royal Academy* at *Paris*, who were joined by Mr. *Celſius*, and the Abbé *Authier*. The Trigonometrical

Part of the Work was performed near the River of *Tornea*, whoſe Direction is the ſame with the Meridian of *Tornea*; the Coaſts of the Gulph of *Bothnia* being found very inconvenient for that Purpoſe. By the favourable Situation of Five Mountains they formed Eight Triangles, which took in Space enough for their Deſign. All the Five Gentlemen obſerved, one after another, each Angle of theſe Triangles, ſetting them down in writing ſeparately.

They afterwards determined the Diſtance between *Tornea* and Mount *Kittis*, under the ſame Meridian, by a Baſis, meaſured on the River when frozen over, whoſe Length was 7406 Toiſes 5 Feet, by the firſt Meaſurement; and when meaſured again, was barely Four Inches over. This Diſtance between them they found to be 55,234 Toiſes.

The firſt Part of their Work being thus finiſhed, the next was to find the Difference of Latitude of theſe two Places: This they did by the Help of a Teleſcope, fixed to a Sector of Nine Foot, made at *London*, by the Care and Direction of Mr. *George Graham*, to whom the Lovers of Aſtronomy are indebted for the curious and well-contrived Inſtruments he has ſupplied them withal. The Star they obſerved at *Tornea* was *α Draconis*: They repeated their Obſervations three times, and the greateſt Difference between them was but Two Seconds: Removing to Mount *Kittis*, they took the ſame Number of Obſervations, of the ſame Star, without finding more than One Second Difference. The Reſult was, that the Amplitude of the Arch, in the Heavens, between *Tornea* and Mount *Kittis*, (allowing for the Preceſſion of the Equinox, and the Time elapſed between the Two Obſervations, according to Mr. *Bradley's* Theory) was 57 Minutes 26 Seconds. Hence the Magnitude of a Degree, on the Earth, interſecting the Polar Circle, was found to be greater than a mean Degree of *France* 377 Toiſes; and to differ 900 Toiſes from what it ſhould have been, according to Mr. *Caſſini's* Hypotheſis: And if the Correction, according to Mr. *Bradley's* Theory, were omitted, the Difference would have amounted to above a Thouſand Toiſes: The Conſequence of which, ſay the curious Obſervers, is, That the Earth is not only flatted towards the Poles, but that it is much more ſo than Sir *Iſaac Newton* or Monſieur *Huygens* thought it. This unexpected Difference being ſo very great, made them reſolve upon a careful as well as new kind of Verification of the Whole. In the firſt Place, they repeated their Aſtronomical Obſervations Three ſeveral times, at *Tornea* and *Kittis*, with the ſame Inſtrument, but on another Star, *viz.* δ *Draconis*: The Difference of Latitude between the Two Places was found to be the ſame, within Three Seconds and an half, with the Firſt. They then not only examined the Truth of their Meridian Line, the Exactneſs of the Sector, in the different Diviſions upon the Limb, chiefly in the Two Degrees imployed in obſerving α & δ *Draconis*, but ſuppoſed that, in their Trigonometrical Operations, they had erred in each Triangle, by Twenty Seconds in each of the Two Angles, and Forty Seconds in the Third; and that all theſe Errors tended to diminiſh the Length of the Arch; the Calculation, upon this Suppoſition, gives but $44\frac{1}{20}$ Toiſes for the greateſt Error that could be committed.

When a particular Relation of all theſe Obſervations was read before the *Royal Academy of Sciences* at *Paris*, and inquired into; the main Exception taken to them was, That the Obſervers, omitting to make a Proof of the Line of Collination, by means of double Obſervations, with the Face of their Inſtrument turned contrary Ways, have thereby not duly aſcertained the Truth of their Obſervations. But this Objection was fully anſwered by Monſieur *Maupertuis*, as Mr. *Celſius* hopes and believes, to the intire Satisfaction of Monſieur *Caſſini*, who made it. He allows M. *Caſſini* had very good Reaſon to mention this, as a thing proper to be done in Inſtruments of common Uſe, for this Purpoſe, which generally ſtand in need of ſuch a Method of Verification: But it was not at all neceſſary in the Inſtrument uſed at *Tornea* and Mount *Kittis*: The very Make of it was ſuch, that no Alteration could eaſily be made in it, ſo as to create any perceptible Error in the Obſervations. The whole Apparatus of the Teleſcope and Sector is all framed together; the Object-glaſs and Croſs-wires, as well as the Limb, ſo firmly fixed to the Tube, as not to be diſlocated without great Violence. Notwithſtanding all this, the utmoſt Care was taken in tranſporting it from one Place to another; being placed in a Cheſt, that the *Laplanders*, to uſe his own Words, *in illa ciſta idolum quoddam ſervari facile ſibi perſuaderent*. He adds, the ſame Objection may be made to Monſieur *Picard*'s Obſervations, who does not ſeem to have uſed this Precaution, as Monſieur *Caſſini* himſelf acknowledges, who nevertheleſs approves and extols his Obſervations for their Accuracy: So that thoſe at the Arctic

Circle may be very good, notwithſtanding the want of this, ſuppoſed neceſſary, Operation. And indeed, that they were ſo, ſufficiently appears from this Fact. The Difference of Latitude between *Tornea* and Mount *Kittis*, found in *September*, was obſerved again in *March* following, by the Help of the ſame Star δ *Draconis*, and did not differ from the former above 3 ½ Seconds, though the Inſtrument had been twice carried from one Place to the other. This is a Degree of Exactneſs not eaſy to be met with; no not in Monſieur *Caſſini*'s Obſervations, made on different Stars, which differ ſometimes 40 Seconds, in determining the Amplitude of an Arc in the Heavens, though their Inſtrument was carefully examined in the way above-mentioned.

The Author then proceeds, in his Turn, to inquire into the Accuracy and Certainty of the two Sets of Obſervations made in the North and South Parts of *France*, in reſpect of the Royal Obſervatory at *Paris*.

As to the Meaſures of the Degrees in the Northern Parts of *France*, between *Paris* and *Dunkirk*, he owns they cannot be much out of the way; being in ſome meaſure confirmed by Monſieur *De la Hire*, in the Year 1683. and Monſieur *Caſſini* himſelf. Yet Mr. *Celſius* obſerves, that the Baſis on the ſandy plain Shore, near *Dunkirk*, when meaſured again, differed Three Feet from the former Meaſurement; which is a much greater Difference than that Mr. *Celſius* and the other Gentlemen found, in meaſuring a much longer Line twice over, which was but Four Inches.

As to the Aſtronomical Obſervations taken by the Six Foot Sector, whoſe Limb of 12 Degrees was divided only at every 20 Seconds; it is true, Monſieur

*Caſſini* examined the Inſtrument ſeveral ways, at *Paris*, after his Return thither: but that a Correction, owing to the Change of Centre, might be ſafely applied to the Obſervations at *Dunkirk*, the Examen of the Centre ſhould alſo have been taken at *Dunkirk*; it being uncertain, whether this Alteration or Aberration of the Centre was cauſed by the Journey to or from *Dunkirk*.

The Difference of 41 Seconds between the Obſervations taken to ſettle the true Meaſure of the Arc of the Heavens, ſeems to be enormous. Perhaps the Stars were not lucid enough to be well obſerved by the Three Foot Tube; but might they not, for a due Degree of Accuracy, have been viewed through the Nine or Ten Foot Teleſcope?

Our Author prefers the Obſervations of 1719, made after the Return to *Paris*, to thoſe made before; becauſe made at the ſame time of the Year with thoſe of *Dunkirk*, and ſo not ſtanding in need of Mr. *Bradley*'s Correction: Though this Caution, perhaps, may be thought not neceſſary here, where the Errors of the Obſervations are greater than the Correction itſelf. Mr. *Celſius* remarks farther, if the Difference of Latitude between *Dunkirk* and *Paris* be ſuppoſed to be Two Degrees 12 Minutes 12 Seconds and an half, which is a Mean between Four others he mentions, the Length of a Degree will amount to but 56,395 Toiſes. And if the Obſervations at *Malvoiſine* and *Amiens*, be counted according to Mr. *Bradley*'s Theory, for the Interval of a Month between the Obſervations, the Length of a Degree will come out to be 56,926 Toiſes; which is 135 Toiſes leſs than the Length of a Degree, found by meaſuring the whole Length of *France*; and 134 leſs than that of Mr. *Picard*, ſo highly approved of by Mr. *Caſſini*, as confirming his own.

*The Reflections Mr.* Celſius *makes upon the Obſervations*, &c. *taken in the South Parts of* France, *ſhall be referred to another Meeting.*

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## *The Continuation of the Remarks made by Mr.* Celſius *on the Obſervations taken in* France, *in order to aſcertain the true Figure of the Earth.*

MR. *Celſius* having finiſhed his Remarks upon the Obſervations made in the North Part of *France*, extending from *Paris* to *Dunkirk*, proceeds to examine thoſe taken in the South, from *Paris* to *Collioure*, near the Borders of *Spain*, and the *Pyrenean* Mountains. By the former, a mean Degree was found to conſiſt of 56,960 Toiſes, by the latter 57,097; and conſequently the Earth is an oblong Spheroid.

Mr. *Celſius*, in examining theſe Obſervations, which were taken under the Conduct and Direction of the late M. *Caſſini* in 1700, firſt conſiders the Structure and Goodneſs of the Inſtruments uſed; then the Accuracy of the Aſtronomical Obſervations for finding the Difference of Latitude; and, in the laſt place, the Trigonometrical Operations for determining the Diſtances of Places; eſpecially the two Extremes under the ſame Meridian.

The principal Inſtrument M. *Caſſini* carried with him, was, a Limb of 12 Degrees, whoſe Radius was indeed 10 Foot, but divided only into Degrees and Minutes; the other Parts were added to it at *Perpignan*. Here Mr. *Celſius* obſerves, that the finding the true Centre of this Limb was and ſtill is a very difficult and troubleſome Problem to a good Artiſt; that no mention is made, whether the Poſition or Place of this Centre, and the Diviſions of the Limb, were ever examined at *Paris* or *Collioure*, though the Carriage of the Inſtrument through ſo long and rough a Way, could not but make ſome Alteration in the Place of the Centre.

It is true, the Zenith Diſtance of *Capella*, taken by it at *Paris*, was confirmed to be right by another Inſtrument; but it cannot be concluded, that the Zenith Diſtance of the ſame Star, taken at *Collioure* by this Inſtrument, and not confirmed there by another Inſtrument, muſt be true alſo. For the Point of Diviſion, anſwering to this Diſtance in the Limb, was not examined; and a Centre wrong placed may by Accident give the true Zenith Diſtance, *viz.* when the true and erroneous Centre happen to lie in the ſame Perpendicular to the Horizon.

The Exceptions taken to the Aſtronomical Obſervations for finding the Difference of Latitude between *Paris* and *Collioure*, are, in the firſt place, That though Five Stars were obſerved at *Collioure* and *Paris*, yet One only was made uſe of, *viz. Capella*: That the Difference of Latitude by *Capella* is 6° 18′ 57″: If *Lucida Lyra* had been uſed, the Difference would have been but 6° 17′ 7″; but by the Right Shoulder of *Auriga*, 6° 19′ 25″: Hence ariſes the

Uncertainty or Difference of 2′ 18″ between the greateſt and leaſt of their Obſervations: That the late Mr. *Caſſini* makes the Difference 57″ leſs than Mr. *Caſſini*, who accounts for this Difference from the Obſervations being taken by an ordinary Inſtrument; but the Inſtrument is the ſame which was uſed to take the Altitude of the Pole of *Amiens*, which was very near that found by Mr. *Picard*.

As to the Trigonometrical Operations for finding the Diſtance of Places, Mr. *Celſius* thinks they labour under conſiderable Uncertainties; not only on the Account of the many Difficulties they met withal, *viz.* mountainous Countries, want of proper Signals, *&c.* ſo that convenient Triangles could not be formed; but add to all theſe, ſeveral of the Triangles had but Two Angles obſerved, and ſome of theſe Angles too acute; whence, as Mr. *Caſſini* himſelf very juſtly obſerves, in his Examination of *Snellius* and *Riccioli*'s Obſervations, great Errors may ariſe. Mr. *Picard* thinks all Angles leſs than 20 Degrees ought to be avoided; as alſo that the Triangles ſhould be contrived ſo as to have Sides of a due Length, neither too great nor too ſmall: Then follow 16 Triangles, wherein one or more of theſe Inconveniences are to be found.

It may be ſaid, the Whole of theſe Obſervations and Meaſures of Monſieur *Caſſini* ſeem to be ſufficiently confirmed, if not aſcertained; ſince the principal Baſe in *Rouſſillon* was found, when computed, to differ but Three Toiſes from the ſame as it was actually meaſured; and that, after ſome due Corrections, it was made to agree with the greateſt Exactneſs. Mr. *Celſius* replies, Why are we not told what thoſe Corrections were, that we may ſee whether they were really neceſſary or no? Why were they not taken notice of in the Calculations of each Triangle? Beſides, the real Length of the Baſe, or the fundamental Line, in *Rouſſillon*, is not fully aſcertained, it not being meaſured more than once; whereas that at *Dunkirk* and that of Mr. *Picard* were meaſured twice; and there was more Reaſon for doing ſo here than at *Dunkirk*, on account of the uneven and almoſt ever changing Shore in *Rouſſillon*, from the reſtleſs overflowing Sea.

The great Number of the Triangles, joined with the numerous ſmall Errors of the Angles, is another Ground of Uncertainty; for the Errors in the Angles, though ſmall, may make the Diſtance of the Parallels of the Two extreme Places greater than it ought to be; and yet the principal Sides, that is, thoſe that are made Baſes to the following Triangles, continue the ſame. This made it neceſſary to verify the Sides, at leaſt at every ſecond Degree, by meaſuring the principal Baſe twice over with due Care; which might have been done, and therefore ſhould have been done, in a Matter of ſo much Nicety as an Attempt to find the Difference between Two Degrees ſo near one another, under the ſame Meridian.

To ſhew what bad Conſequences may ariſe from ſmall Errors committed in obſerving the Angles of ſeveral Triangles, Mr. *Olavus Hiorter*, a curious and ingenious Friend of Mr. *Celſius*, has taken the Pains to form the Triangles of Mr. *Caſſini* between *Bourges* and *Collioure*; ſo that the Diſtance between their Parallels ſhall be conſiderably leſſened; and yet the Baſe in *Rouſſillon*, found by Computation, ſhall not, after due Correction, differ ſenſibly, if at all, from the ſame actually meaſured. In conſequence of this, Mr. *Celſius* concludes with obſerving, that the Diſtance between the Royal Obſervatory and the Perpendicular to the Meridian of *Collioure*, deduced from the Triangles of *Caſſini*, corrected after Mr. *Hiorter*'s Method, *&c.* will amount to but 358,980 Toiſes. This, divided by the mean Difference of their Latitudes, 6° 19′ 11″, will give 56,803 Toiſes, for the Length of a Degree, one with another, between *Paris* and *Collioure*, which is leſs than the Length of a mean Degree found by Mr. *Picard*, and pretty near the Truth: So that the Degrees decreaſe as you go towards the Equator; and conſequently the Earth is higher at the Equator than at the Poles, as Sir *Iſaac Newton* and Mr. *Huygens* believed.

The Diſtance of the Parallels of *Paris* and *Collioure* by this Method is indeed leſs than that computed by Mr. *Caſſini*; but this cannot reaſonably be complained of, ſince theſe computed Meaſures of Mr. *Caſſini* ſeem very capable of being leſſened; and it is no more than what Mr. *Caſſini* himſelf hath done to the Meaſures publiſhed by his Father, which he has ſhortened by 325½ Toiſes. But however that Matter be, whether this particular Correction of Mr. *Caſſini*'s Diſtance, and, conſequently, Length of a mean Degree, be admitted or no, Mr. *Celſius* is fully perſuaded, upon the Whole, that he hath made it plain to every unprejudiced Reader, that theſe Two Sets of Obſervations in *France* are not taken with ſuch a Degree of Exactneſs as to be depended upon, in determining ſo nice a Matter, in Diſpute for 50 Years, as the true Figure of the Earth; which was the thing propoſed to be done by them.

## II. *A Letter from Mr.* J. Alexander *to* Peter Collinſon, F. R. S. *concerning a Place in* New-York *for meaſuring a* Degree *of* Latitude.

*SIR,* *New-York, July* 21. 1740.

THE Mention of the *French* Endeavours to diſcover the Figure of the Earth by Obſervation, puts me in Mind——That a very exact Obſervation for that Purpoſe might be made here, becauſe *Hudſon*'s River here is frozen over from *New-York* up to *Albany*, and its Courſe is very ſtrait, almoſt true North, and the Diſtance between *New-York* and *Albany* is above One hundred and Fifty Miles; *New-York* is in Latitude of 40° 40′, nearly; ſo that the Length of above Two Degrees of Latitude on the Earth might be meaſured here, with much more Exactneſs than it was poſſible in *England* or *France*, becauſe of the Aſcents and Deſcents, and curved Lines, which, I think, they would continually be obliged to make Allowances for.

From all which Difficulties the Menſuration here on the Ice would be intirely clear.

Yours,

*J. Alexander.*

III. *Ex-*

## III. *Ex Veterum* Pruſſorum RE ANTIQUARIA *Schediaſma, a D.* Jac. Theodoro Klein *Reipubl.* Gedan. *a Secretis,* R. S S. *cum D.* Hans Sloane, *Bar*$^{t.}$ R. S. *Pr. communicatum.*

INTER varia Veterum Pruſſorum & Utenſilium & Luxus ſui vel Ornamenti monumenta, olim circa funerationes terræ concredita, rurſus e terra aliquando eruuntur ex Ære ductili affabre tornatæ complicatæque triplices lineæ, quæ vel laxatum Cingulum ex unico aut duplici triplicive circulo conſtantem effingunt, vel Coni figuram e baſi ſua per Spiram aſſurgentis, apice truncato repræſentant, cujus Spiræ ex ære nobiliori tam egregia elaſticitas, ut facile comprimi & facilius in figuram conoidalem remitti queat, ita quidem, ut plus quam quatuor horæ minuta requirat, antequam ab impulſu requieſcat.

Prioris Generis de Hiſtoria naturali optime meritus *Helwingius Præpoſ. Diœco. Algerb. Lithograph.* I. *p.* 91. §. 2. Funiculos metallicos vocat, eoſque Cinguli loco deſtinatos fuiſſe recte judicat; illos, qui in Conum truncatum aſſurgunt, CORONAS SEPULCRALES (*ibid.* §. 4.) appellat, in Sepulcretis obvias, ſed rariſſime integras.

SIMILEM, ex omni parte integram & liberam ab Ærugine, (*vid.* TAB. I. Fig. 1.) cujus Diameter in baſi $6\frac{7}{8}$ pollices Rhinland. adæquat, anno 1726. in Muſeum noſtrum depoſuit vir admodum Reverendus, ſimulque Sententiam ſuam in literis ad me datis expoſuit; nimirum, hujuſmodi Conum ſpiralem fuiſſe Simulacrum Serpentis ænei Iſraelitarum, cum quibus veteres

Pruſſi multa circa Cultus ſuos Idololatricos communia habuerint, quod Simulacrum demum loco Amuleti in Sepulcra depoſuerint; ut Serpentes, quos Pruſſi veteres pro Diis coluerunt, poſt obitum quoque reverenter habiti, Cadaveribus non nocerent.

Proculdubio Vir Doctiſſimus hujus gratia ſecutus eſt Caſtra eorum, qui Virgines Veterum Pruſſorum ab Iſraelitis, quos *Salmanaſſar* in captivitatem abduxit, deducere ſatagunt; quorum tamen opinionem *Chriſtoph. Hartznoch*, *Diſſert.* III. *p.* 48. §. v. labefactavit.

Aſt, licet verum ſit, Pruſſos Ethnicos præter DIOS TRES majores, *Percunum*, *Pikollum*, & *Potrimpum*, imo præter Solem, Lunam, Stellas, Lucos, Fontes, Alcem, Bufones, aliaſque Beſtias, etiam Serpentes veneratos, eoſdemque & cultu & litamine ex lacte parato, in Quercubus præcipue cavis, quæ inauditæ plerumque magnitudinis & craſſitiei, (*vid. Hartknoch Diſſert.* VI. *de locis Divino cultui dicatis*) proſecutos eſſe *; licet quoque egomet ipſe in Lithuania Pruſſiæ orientali ſubjecta ſæpius obſervaverim, Serpentes infantibus adeo familiares eſſe, ut iiſdem cochlearia lacte plena circumverterint, quorum eſurientium ejulatu Parentes accerſiti nihil contra indiſcretos hoſpites auſi ſunt, niſi quod eoſdem pariter ac volatilia domeſtica a prandiis liberorum fugaverint: nullatenus tamen exinde inferri poterit, Pruſſos antiquos hac ærea Spira reſpectum habuiſſe ad Serpentem æneum MOÏSIS, niſi nobis etiam perſuadere velimus, quod reſpectu Afflictionum Ægyptiacarum, nimirum 2dæ, 3tiæ, 4tæ & 8væ, Bufones, Ranas, & plurima Inſecta ſingulari cultu ſint proſecuti, eorundemque ſimulacra ſibi comparaſſe. Neque veriſimile eſt, ex veneratione erga Serpentes, quos, forſan ultra numerum, vivos in Ollis conſervarunt, iiſdemque valde familiares fuerunt, eorum inſuper Idola, & multo minus Amuleta Serpentiformia fabricaſſe, ut Cadaveribus ſepultis de Serpentibus caverent, cum extra dubium eſt, quod veteres Pruſſi mortuos non aliter quam crematos terræ mandaverint, cujuſmodi funerationes temporibus Ducis *Alberti* necdum aboliri potuerunt, hinc Cadavera Amuletis contra injuriam Serpentum non indiguiſſe. Cum, quod reliquum eſt, notiſſimum ſit, veteres Pruſſos per Secula rudiſſimum fuiſſe populum, (*vid. Henneberger, in libr. de vet. Pruſſ. fol.* 5.) qui nec lanas ducere, nec ferrum, multo minus ænea vel utenſilia vel luxui inſervientia vaſa parare didicerint, quin potius pro Haſtis & Enſibus Clavos horribiles, & pro malleis cuneiſque ferreis lapides ad uſus & domeſticos & bellicos (qui diu ſub nomine Cerauniarum venditati ſunt) adaptaverint, nihilominus tamen non ſine omni induſtria.

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* Qua ratione, quibuſve Cæremoniis epula Serpentibus ſint parata, vid. *Hartkn. in Ant. & Nova Pruſſia, p.* 63. *Conf. Diſſert. ejus* VIII.

Summa itaque præmiſſorum hæc: Ceimelium noſtrum nullam relationem ad ſimulacrum Serpentis ænei Moïſis habuiſſe, multo minus Probabilitatem Amuleti contra morſus Serpentum involvere; neque ex antiquiſſimis veterum Pruſſorum temporibus, ſed ex medio potius eorum ævo originem trahere.

Unde autem Clariſſimus *Helwingius* in *Alleg.* §. 4. adductus fuerit, ut vetus hoc monumentum titulo Coronæ Sepulcralis inſigniverit, hariolari non poſſumus; quippe neque figura ullo modo Coronam æmulatur, niſi dicere velis, Philoſophiam Pruſſorum, occaſione funerationis, quæ cauſa quandoque maxime lugubris, prout mors homini naturali omnium terribiliſſimum eſt, Coronæ loco ejuſmodi Spiram tremulam excogitaſſe; neque apud ullum Auctorem veſtigium apparet, veteres Pruſſos mortuos ſuos cum ejuſmodi Cæremoniis, quibus nos utimur, ad funerationes exportaſſe, ita ut Virginis vel Juvenis loculum Corona ornaverint; cum neque ullibi Coronæ Sepulcralis mentio ſit facta, quæ in honorem Defuncti vel ad latus ejuſdem, vel ad caput, vel etiam ad pedes, prout apud nos viris, qui in Cœlibatu ſupremum obierunt diem, in Sepulchro depoſita fuerit.

Sufficient autem ſequentia, quæ Summam rituum funerandi Defunctos exhibent ex fide noſtri *Hartknochii Diſſert.* XIII *de Funeribus Vet. Pruſſ. p.* 193. *ſeq.* præter reliqua: "Cum Defunctus erat tumulo "inferendus, primo pyræ impoſitus comburebatur, "deinde optimæ quoque veſtes rogo injiciebantur, ut "& canes venatici, equi, arma, aliaque defuncto, "dum viveret, acceptiſſima.—Injiciebant quoque "Annulos æreos, ut & Armillas æreas, præſertim ſi "defunctus Chriſtianorum ſacra ſuſceperat." Et paulo poſt ex *Eraſmo Stella*: "Exutos ſpiritu, ar"matos veſtitoſque, ac magna Supellectilis parte "circumpoſita, humarunt."—Demum ex *Jacobi Leodinenſis* Privilegio Pruſſis dato: "Promiſerunt "(Pruſſi) quod ipſe & Hæredes eorum in mortuis "comburendis vel ſubterrandis cum equis, ſive homi"nibus, vel cum armis ſeu veſtibus, vel quibuſ"cunque aliis rebus pretioſis, vel etiam aliis quibuſ"cunque ritus gentilium de cætero non ſervabunt,

" ſed mortuos ſuos juxta morem Chriſtianorum in
" Cœmeteriis ſepelient."

His omnibus rite perpenſis, confidimus jure affirmare poſſe, Monumentum, de quo nobis ſermo eſt, ad Supellectilem veterum Pruſſorum, & quidem Nobilioris Ordinis ſpectaſſe, & non niſi Armillam, qua defunctus vel defuncta, ſive in ſignum optime de Patria meritorum vel Nobilitatis, ſive ſingularis ornatus luxuſque gratia uſi ſunt, fuiſſe, quæ cum reliqua Supellectilis parte circum Cadaver poſita tali modo in terram devenerit, donec noſtris temporibus aliquando in lucem rurſus extrahatur.

Confirmavit ſententiam noſtram Doctiſſimus *Thomas Bartholinus*, qui *in Schedio* ſuo *de Armillis Veterum*, *pag*. 48. figuram exhibet Armillæ Brachialis pluribus Circulis inter ſe connexis ex Muſeo Antiquario *Olai Wormii*, nunquam ab aliis annotatæ; quam *pag*. 49. ſtupendæ Antiquitatis monumentum, dignum poſterorum memoria appellat. Quæ ſi cum noſtro Ceimelio debite conferatur, neſcio, quid obſtaret, quo minus Noſtram Armillam Brachialem veterum Pruſſorum, & quidem pari jure cum *Wormii* Armilla, ſtupendæ Antiquitatis noſtræ monumentum, nunquam ab aliis annotatum dignumque Poſterorum memoria ſalutaremus.

Structura ejus laxior inſuper magiſque fluens, quam *Wormii* Armilla, eſt, ita ut ſuper manica Brachii applicata Humerum Cubitumque ſimul commode ſtringere poſſit. Neque pro Plebeia, quod ærea eſt, cenſeri credas; cum aureas vel argenteas apud nos unquam effoſſas non audiverim. Aſt Plebeiarum veſtigia in hunc uſque diem ſuperſunt circa Ornatus utriusque Sexus in Lithuania Pruſſiæ orientalis, qui veri Pruſſorum veterum Deſcendentes, & Curlandiæ, qui diebus in primis ſolennibus Oſſa Cubiti eadem plane figura, qua Armilla ærea apparet, arctius licet, vel ex ſerico & lana contextis faſciis (ſi ditiores ſunt) vel Fimbriis variegatis cujuſcunque Panni (ſi pauperiores) conſtringunt. Moris iiſdem adhuc quoque eſt, Abdomine minimum duobus & quidem ſimilibus cingulis vincto, ſuperbire.

Propter affinitatem cum Armilla hac Brachiali veterum Pruſſorum, libet eidem adjungere Annulum ragenteum, (*vid.* TAB. I. Fig. 2 & 3.) quem ante annum, & quod ſuperfluxit temporis ſpatium, vir prænob. Dn. *Andreas Lilienthal*, S. R. Maj. Boruſſ. a Conſiliis Belli & Redituum, Cameræ Regalis, in Urna Pruſſica effoſſa inventum mihi tradidit, ſimilibus lineis convolutis pro Gemma contextis, reliquo in duas extremitates ſibi non conjunctas, ſed invicem vicinas, circulumque formantes, excurrentem, ita ut digitum plus minuſve craſſum æqualiter ambire poſſit.

Expedito hoc Schediaſmate a Viro Conſulari Graviſſimo Dn. *C. G. Ehlero* ex Diario, quod 1734. & 1735. Petropoli præſens per Filium ſuum conſcribi curavit, & edocti ſumus, Toreumata non niſi Aurea varii generis, ad noſtrum Ceimelium æreum proxime accedentia in ditiſſimo totius Ruſſiæ Autocratricis Antiquitatum Theſauro, ubi inprimis Sinenſia aſſervantur, obſervata: Quæ Bibliothecarius Sacræ Imperialis Majeſtatis ex Sepulcretis, neſcitur tamen cujus regionis, effoſſa eſſe & pro Armillis haberi affirmaverat.

IV. *Ob-*

## IV. *Obſervations and Experiments with* Madder-root, *which has the Faculty of tinging the Bones of living Animals of a red Colour, by* M. Du Hamel du Monceau, F. R. S. *&c. communicated in a Letter to Sir* Hans Sloane, *Bar*t. *Pr.* R. S. *Tranſlated from the* French *by* T. S. *M. D.* F. R. S.

IN the Month of *February* 1737. (*N. S.*) Monſieur *Geoffroy* communicated to the *Royal Academy of Sciences* at *Paris*, the following Obſervation, extracted from a Letter of Sir *Hans Sloane*, Bart. Preſident of the ROYAL SOCIETY of *London*, to him.

" Mr. *Belchier*, a Surgeon, and Member of that " SOCIETY, dining one Day with a Callicoe-printer, " remarked that in a Leg of freſh Pork, the Fleſh of " which was well-taſted, the Bones were red. He " asked the Cauſe of ſo ſingular a thing, and was " told, that theſe Callicoe-printers make uſe of the " *Rubia Tinctorum*, or *Madder-root*, to fix the Co- " lours printed on the Cloth. Some of theſe Colours " are made with Preparations from Iron, others with " a Mixture of Alum and Sugar of Lead. The Parts " printed with the Preparation of Iron, produce " Black and Purple; thoſe printed with the Mixture " of Alum, Red of different Degrees. Theſe Cal- " licoes are afterwards boiled in a Copper with Bran, " in order to clean them from a dirty red Colour " occaſioned by an Infuſion of *Madder-root*. In " fine, that this Bran ſhould not be loſt, though "charged with a red Colour, it is mixed with the "uſual Food of theſe Hogs; and this is what produces this Effect on their Bones, without cauſing "the leaſt Alteration either in the Fleſh, Membranes, "Cartilages, or any other Parts of the Body. Mr. "*Belchier*, whoſe Obſervation here related has been "communicated to the Public in N° 442. and 443. "of the *Philoſophical Tranſactions*, deſiring to be "aſſured whether the *Madder* alone, or all the Ingredients blended together, produced this Colour "in the Bones, made ſome other Experiments.

"He mixed ſome of the *Madder-root* with the "Food with which he intended to feed a Cock. "The Cock dying within 16 Days after his firſt "feeding on the *Madder*, he diſſected him, and was "ſurpriſed to find, that the Root had produced its "Effect in ſo ſmall a time; for he found the Bones "univerſally of a red Colour. Whence he concludes, that the *Madder* alone cauſes this Alteration; as he had not mixed either the Iron, Alum, "or any of the other Ingredients of the Dyer, with "the Cock's Food. He remarked, that the red Colour penetrated into the internal Parts of the Bones, "and that the hardeſt Bones took more of this Colour than the ſofter ones; excepting the enameled "Part of the Teeth, which in the Hog retained its "Whiteneſs."

Mr. *Belchier* promiſes, at the Cloſe of his Obſervation, to try further Experiments, in order to know with Certainty, why this Change of Colour takes place only in the Bones. But as he has not publiſhed any thing more than what I have above related, I think myſelf at Liberty to communicate to the Public the Experiments I began to make in the Country, ſoon after the Obſervation came to my Knowledge. They are a Confirmation of it, and diminiſh nothing of the Merit of the firſt Diſcovery.

It is proper to obſerve, that *Mizaldus*, in a Work publiſhed in 1566. with this Title, *Memorabilium, utilium ac jucundorum Centuriæ novem*, (Cent. 7. No. ) has theſe Words: "Erythrodanum, vulgo "Rubia tinctorum dictum, oſſa pecudum rubenti "& ſandycino colore imbuit, ſi dies aliquot illud "depaſtæ ſint oves, etiam intacta radice, quæ rutila "exiſtit, *&c.*"

Firſt, I took Four ſtrong Pullets, which I ſhut up in Coops. I fed them with a Paſte made of Wheat-meal and Powder of *Madder-root*; and gave them an Infuſion of the ſame Root to drink, which I was in hopes they would have no Diſlike to. The firſt Days they eat their Paſte pretty well; but I found, that the Addition of the *Madder* rendered it much leſs agreeable to them than that made of the Meal alone, on which they fell will much greater Eagerneſs than on the other, when, to try their Reliſh, I now-and-then gave them ſome of it. As to the Infuſion of the *Rubia Tinctorum*, they never would drink it, and I was obliged to give them pure Water, which they drank plentifully; for this Root made them thirſty. In ſhort, at the End of ſome Days they could not reliſh the Mixture, of which they eat but very little, and waſted away viſibly.

On the 10th Day, one of them died; and another Two Days after: and both of them had their Bones tinged of a Roſe-colour. In order to prolong the Lives of the other Two, I diminiſhed the Doſe of the *Madder*, and from time to time I gave them the Paſte without it. The Root had already produced its Effect; for notwithſtanding the new Regimen, they continued to waſte; which obliged me to kill the Third Five Days after the Death of the firſt Two. The Colour of its Bones was not different from that of the Two, who died Five Days before. As to the Fourth Pullet, which ſeemed not quite ſo ſick, I marked it on the Leg with a Bit of Cloth tied round, and ſet it at Liberty. It recovered by degrees, by chooſing Food to its Taſte in the Yard. But at the ſame time the Tincture its Bones had received, went off gradually, and almoſt intirely diſappeared in a Month's time. For I took care to obſerve the Change every ſecond or third Day, by looking at the Bones on the Under-ſide of the Wing, which have no other Covering than a thin Skin.

From this Experiment, as from that of Mr. *Belchier*'s Cock, it appears, that the *Madder-root* is alone ſufficient to tinge the Bones of Animals red, which eat it. The Bones of my Pullets had taken no more than a Roſe-colour; becauſe theſe Creatures, being diſguſted with their Food, never eat of it, but when urged by extreme Hunger: And I had never been able to tinge them of a fine red Colour, had I not repeated the Experiment on ſuch Animals as I could feed with the Paſte, and had it in my Power to make them ſwallow *Madder* in large Quantities.

For that Purpoſe I choſe young Pigeons, the ſtrongeſt of a whole Pigeon-houſe. Two of theſe had no other Food given them but Wheat-meal, others were fed with the Meal and *Madder* mixed and made into Pellets of a convenient Size, given them Three times a Day till their Crops were full. I endeavoured to make the young Pigeons drink of the Infuſion of *Madder*, which were fed with the Root and Meal; but I could never ſucceed, and was obliged to give them Water alone, as to the Pullets of the Firſt Experiment. The Two young Pigeons fed with the Meal alone were lively and fat, digeſted their Food, and throve as well as if fed by the old ones. But on the contrary, thoſe that were fed with the Paſte of Meal and *Madder*, took this Food only by Force, digeſted ill, were dull and very thirſty. And though Care was taken to keep their Crop conſtantly full, as well as the others, yet they grew leaner daily. They were always ſhivering, and endeavouring to get into the Sun, or near the Fire, to warm themſelves: And the ſtrongeſt of them was very ſick by the 10th Day. I got the Two killed, that had fed on the Meal alone, as well as the others that had the *Madder* given them; and I preſerved but Two, which appeared to me to have better borne the Effect of it than the reſt, and had the Bones of the Wings already tinged red.

One of the Two was intended to be recoverd by a ſimple Diet, in order to ſee, if, by prolonging its Life, the Colour, which was already very viſible in the Wing-bones, would wear off: But in Three Days time it was killed accidentally. However, I thought I perceived the Colour weaker than before the Change of Diet: And the ſame Experiment, repeated ſome time after, confirmed me (in the Notion) that the Change of Food makes the Colour diſappear by degrees. I continued to feed the other remaining young Pigeon with *Madder*, but in ſmall Quantities, for fear of killing it too ſoon. It lived Eight Days longer without any Appearance of the Bones being deeper coloured than the firſt that were killed.

All theſe Creatures, that had been fed with the Mixture, were diſſected; and I made the following Obſervations on them.

Neither the Feathers, the Horn of the Bill, nor Claws, had changed their Colour, even where they are inſerted into the Skin. The Skin of the whole Body had preſerved its natural Colour. The Brain, Nerves, Muſcles, Tendons, Cartilages, *Epiphyſes*, and Membranes, afforded nothing to the Sight contrary to the uſual State of theſe Parts. But the long bony Tendons, that run along the great Bone, which is improperly called the Leg of Fowls, were red about the Middle of their Length, which is their hardeſt Part. All the true Bones, even to the very thinneſt of them, were as red as Carmine; and in ſome Places this Red was ſo deep, that they appeared almoſt black.

In theſe young Birds, all the Bones do not take the red Tinge alike. The hardeſt are generally more coloured than thoſe that are tenderer. A Difference of this kind is perceivable even in the ſame Bone; for the Middle, which has more Solidity than the Ends, is almoſt always the reddeſt. Not but there are ſometimes found little pale Spots in the Part where the Red is deepeſt; and ſometimes Spots of a very deep Red in thoſe Parts which have taken but a Carnation Tinge.

I have always found, that the great Bone of the Foot, which is commonly called the Bone of the

Leg, was viſibly leſs red than the others. I have found the little Bones of the *Larynx* and of the *Apophyſes* tinged of a fine Red, though theſe are as ſmall as a Thread in young Pigeons. The Rings of the *Trachea*, which are intirely cartilaginous, had not taken the leaſt Tinge; but the Ring neareſt the Diviſion of the *Trachea* was red in theſe Pigeons; and even the Firſt Ring of each Branch of the Bifurcation had in ſeveral taken the Tincture, in the Middle at leaſt of its Outſide.

The other Parts of the Thorax, *viz.* The Heart, Lungs, *Mediaſtinum*, *Pleura*, and Diaphragm, remained of their natural Colour. There was nothing remarkable in the Liver, Spleen, Kidneys, nor on the Outſide of the Gizzard; but the inner Membrane of the Crop and Inteſtines, eſpecially the large ones, appeared red. Having waſhed Pieces of theſe Crops and Inteſtines, I found that their outer Membrane continued white, and that the inner, or *Tunica Villoſa*, only was tinged by the *Madder*. At firſt Sight it appeared to me as if injected; but upon examining it with a Glaſs, I ſaw diſtinctly, that it was not a coloured Liquor that was contained in Veſſels, as in Parts injected; but that it was only a ſort of *Fæcula* detained in the villoſe Part of theſe Membranes. It is doubtleſs the Adheſion of theſe tinging Particles of the Root to the ſmall *Villi* of the inner Membranes of the Organs of Digeſtion, that is the Source of all the Diſtempers with which theſe Creatures appeared to be ſeized, while I fed them with the *Madder*. Their Crop eſpecially was relaxed and flabby, as if it had been macerated ſeveral Months in Water; it was eaſily torn, and its inner or villoſe Membrane ad-

adhered ſo little to the others, that it was detached from them in Pieces. It is very probable, that the coloured *Fæcula* detached from the *Madder*, that is, the Part of the Root which gives the Tincture, had obſtructed the ſmall Veſſels and Glands of the Stomach, which might poſſibly occaſion a *Sphacelus* therein. However that be, a certain Quantity of this *Fæcula*, being accumulated there, retarded Digeſtion, and thoſe Animals died hectic, though with a full Stomach.

The Eyes of theſe Animals, while alive, ſeemed as red as thoſe of ſome Parrots. I thought, after having diſſected them, that no other Part was coloured but the *Capſula* of the Cryſtalline: But Monſieur *Morand*, to whom I had ſent a Turkey fed with the *Madder*, obſerved that the vitreous *Capſula* was of a crimſon Red, though neither the vitreous Humour nor the Cryſtalline were dyed: The Eye of this Turkey being larger than thoſe of the Pigeons, the Hand that diſſected it much more dexterous than mine, and the Anatomiſt more knowing, I willingly come into his Opinion. This then is the only ſoft Part, that is really tinged in theſe Animals; for I do not look on thoſe Parts as ſuch, which appear ſo only by their immediate Contact with thoſe Parts that are charged with the Colour: Monſieur *Morand* having, in the Notes he ſent me of his Obſervations, confirmed all that I had before obſerved, there ought to remain no Doubt of what I have here related.

I come to the Examination of the Skeletons, and of all the coloured oſſeous Parts of my Pigeons; in order to compare them with the Skeletons of the Two Pigeons fed with Wheat-meal alone without the *Madder*. The Bones of the firſt were, as I have ſaid above, of a very lively Carmine-red, in ſome Places of a Crimſon; and I have ſome of them of the Colour of yellow Okre; but whence this Difference aroſe, I could not diſcover. Theſe tinged Bones being broke, while freſh, or before drying in the Air, ſeemed to me ſomewhat bigger and fuller of Marrow; but alſo more ſpongy, or of a looſer Texture, and eaſier to break, than the white Bones of the Pigeons fed with Meal only. The Parts of theſe Bones that had the leaſt Degree of Hardneſs, broke between the Fingers, which remained coloured from them: And this Tincture does not come from the Marrow, which continues in its natural State, like all the other ſoft Parts. The ſame Parts in the white Bones were not to be broke in this manner.

If we recollect, that the Pigeons fed with the Mixture of Meal and *Madder* are always in a languiſhing Condition, in a continual Decay; it will be eaſy to judge, that this is the only Reaſon why the red Bones muſt be not ſo well formed, nor ſo hard, as the white Bones of the Pigeons fed with good Aliments. But why are they bigger, and, as it were, puffed up? It is hard to ſuppoſe any other Cauſe of this, but the Interpoſition of the colouring *Fæcula* of the *Madder* between the *Lamellæ* of the Bones. Theſe heterogeneous Particles hinder the immediate Contact of theſe *Lamellæ*; and thence proceeds the preternatural Increaſe of their Size, and their little Solidity. Upon viewing theſe Bones with a good Glaſs, their ſmootheſt Surface appears bored with a vaſt Number of ſmall Holes, in which the colouring *Fæcula* is perceived. And with a Microſcope that magnifies ſtill more, there appears a ſort of Net-work of Fibres, which divide, and reunite, to form this Net. Under the firſt Order of this Net-work, which appears white, another is ſeen ſomewhat red, and under this a Third and a Fourth, ſtill deeper coloured: In fine, the Ground under all theſe reticular *Strata* is of a very deep Red; and the Whole may be juſtly enough compared to a Piece of Wood ſtripped of its Bark. It is probable, that this ſort of Injection, made by the way of Digeſtion, might lead an able Anatomiſt to ſome very uſeful Diſcoveries on the Nature and Formation of the Bones. Nay, I think I have already found out ſomething new on this Head; but, as I have ſtill ſome Scruple remaining on my Obſervations, I will not venture to communicate the Conſequences drawn from them.

In order that the *Madder* ſhould produce the above related Effect on the Bones, its Tincture muſt have ſuch a Degree of Fixity, (according to the Dyers Term) as not to be changed by the diſſolving Action of the *Saliva*, of the Juice of the Stomach, of the pancreatic Juice, of the Bile, *&c.* nor by the periſtaltic Motion of the Stomach and Inteſtines; and yet theſe Juices act ſo powerfully on common Aliments, that after Digeſtion they are not to be known either by their Smell, Taſte or Colour. This is not all: Theſe colouring Particles muſt be ſmall enough to paſs with the Chyle into the Blood, and circulate with it through a great Number of Strainers or Veſſels, without being ſeparated, and without being depoſited either in the Liver, Spleen, or Pancreas.

I ſtrongly ſuſpect that Portion of the Lymph of the Blood, which is fit for nouriſhing the Bones, might be the true Diſſolvent of the Tincture of the *Madder*, and might convey it to the Place whither it carries Nouriſhment to the ſolid Parts of the Body of theſe Animals. In conſequence of this Conjecture, which I ſhall reſume in the Sequel, I thought that the Skeletons of young Animals ought to take a ſtronger and quicker Tincture, than thoſe of full-grown Animals; becauſe the Bones of young Animals are in a State of Growth, which requires a greater Quantity of oſſeous Juice. It is likewiſe true, as above ſaid, that it is the hardeſt Bones of young Animals, that imbibe moſt of the Colour. All theſe Conſiderations gave Riſe to a Difficulty, which was to be cleared up.

Wherefore, in the Beginning of laſt *October*, I choſe Two Turkeys of the Year, the ſtrongeſt I could find, and young Pigeons in their firſt Hair or Down. I could wiſh to have made the Experiment on Animals of the ſame Species; but it was impoſſible to find young Turkeys in their firſt Down at that Time of the Year: And beſides, theſe Animals being extremely tender during the firſt Months, their Stomach would never have been able to bear the Effect of the *Madder*. As to old Pigeons, I had no tame ones: The wild are difficult to be fed with the Paſte; and if they were ſuffered to feed at Diſcretion, they would not have been ſufficiently *maddered*, if I may be allowed this Expreſſion. However, the Bones of my Two Turkeys were very hard, in compariſon of thoſe of the young Pigeons: And thus I had in theſe Animals, though of different Kinds, all that was of Importance for my Experiment.

My young Pigeons, fed with the Paſte mixed with *Madder*, died the Third Day; yet all that had the Conſiſtence of Bone in their Skeletons, was become as red as Scarlet. Mr. *Belchier* was ſurpriſed to ſee the Bones of his Cock tinged red in Sixteen Days, and here are Bones ſo coloured in Three Days. But all that ſhould in Courſe of Time have turned to Bone in One of my young Pigeons, and as yet was but Cartilage, as the *Epiphyſes*, the great *Apophyſis* of the *Sternum*, *&c.* had not taken the leaſt Colour. In the other, there were ſome Spots of a very weak red on the Cartilage of the *Sternum*, which probably began to oſſify. Other Experiments, ſince tried, have taught me with greater Certainty, that the Cartilages in general are not tinged red by the *Madder*, but when they begin to acquire the Conſiſtence of Bone.

If, as I ſuſpect, it is the lymphatic Part of the Blood that is the *Menſtruum* of the colouring Particles of the *Madder*; if this Lymph contains the nutritious Juice of the Cartilages and Bones; why does it not, in carrying with it the colouring Particles it has extracted from the Root, why does it not, I ſay, tinge the Cartilages as well as the Bones? In my Opinion this Difficulty cannot be ſolved but by the Difference of the Pores. In the Cartilages they are too large, the colouring Matter paſſes through them too eaſily, and finding no oſſeous *Laminæ* yet formed, for want of a Surface ſufficiently extended to retain it, it paſſes with the ſuperabundant Lymph through the Pores of the Cartilages. When theſe Cartilages begin to take a proper Conſiſtence, where there are *Strata* of oſſeous *Laminæ* already formed, the Obſtacle exiſts, the colouring *Fæcula* is detained and depoſited there. When the oſſifying Juice is no longer neceſſary for repairing a daily Loſs of Subſtance, as in Animals arrived at their full Growth; beſides that probably this Juice is then much leſs abundant, and conſequently, in proportion, leſs charged with the colouring Parts of the Root; it muſt neceſſarily reſult thence, that the Bones of an adult Animal will be much weaker coloured. And this is what happened to my Two Turkeys, which, though fed for Fifteen Days with the Paſte of Meal and *Madder*, had their Bones tinged but of a Roſe Colour, which appeared to me ſomewhat deeper towards the Ends than the Middle, which, having too much Conſiſtence, could not admit or retain the ſame Quantity of the colouring *Fæcula* as the tender Bones of the young Pigeons. Therefore the Bones of Animals that are ſtill growing, are dyed better and quicker than thoſe of full-grown Animals; and, in my Opinion, for the Reaſons already given. My Two Turkeys had the ſame Ailments with the Pullets of the Firſt Experiment, they fell into a Decay like thoſe, and I was obliged to have them killed in Fifteen Days time.

Here we ſee young Pigeons, whoſe Bones were dyed of a fine Carmine-red in three Days; which is nearly the Time they muſt have for acquiring this Degree of Tincture. By other Experiments on young Pigeons of the ſame Age, I have found, that in Thirty-ſix Hours their Bones were of a lively Roſe-colour, and in Twenty-four Hours they were at leaſt of a Fleſh-colour.

Theſe laſt Experiments prove with what Expedition the Diſtribution of the nutritious Juice is performed in Animals of this kind, which acquire all their Growth in a few Months; and how rapid the Diſtribution is, even in thoſe Parts where the Blood's Circulation meets with the greateſt Obſtacle, as in the Subſtance of the Bones.

As one ought likewiſe to infer from theſe Experiments, that there are vegetable Medicines whoſe chief Tendency is to the Bones, and which conſequently might remedy many of their Diſtempers, I looked on myſelf obliged to employ the *Madder* with this View; but not having it in my Power to raiſe Diſeaſes of different kinds in the Bones of my Animals, I confined myſelf to the Examination of what Effect it would have in a Fracture.

I choſe Four very vigorous young Pigeons: A Thigh-bone of each of them was broke; the Reduction was immediately performed, and ſecured by a proper Bandage. Two of theſe Pigeons were fed with the Meal and *Madder*, and the other Two with the Meal alone. Theſe laſt, notwithſtanding the Pain the Fracture muſt have given them, had always a good Appetite, and in Eight Days they began to walk with their Dreſſing, which was a little looſened. The others fell into the Accidents already mentioned, and died, one on the Tenth, the other on the Fourteenth Day. The Two Pigeons that had recovered were killed, in order to compare the *Callus*.

That of the Pigeons which had not taken any *Madder*, was little, cloſe, and very even: That of thoſe fed with this Root, was large, ſpongious, and uneven: There ſhot out of it a ſort of Vegetation: It broke between the Fingers, and crumbled into ſmall Grains. It is true, that the State of Suffering of theſe Animals, occaſioned by the Hurt, and increaſed by a Food improper for them, might retard the perfect Reunion of their Bones; yet I think, it certainly reſults from this Experiment, and others which I ſuppreſs, becauſe they prove nothing more, that the *Rubia Tinctorum*, taken inwardly, is rather prejudicial than beneficial in the Caſe of Fractures; and it is not without its Uſe to know what is to be avoided.

The *Rubia*, probably, is not the only vegetable Subſtance that can change the Colour of the Bones; and yet I have tried the Log-wood, the *Anchuſa* and *Curcuma*, without Succeſs. In all Likelihood, it muſt be a Subſtance leſs ſuſceptible of Alteration; and it is well known, that the *Rubia* is of that ſort, ſeeing the Cloths dyed with this Root bear very well the Action of the Air, and that of boiling.

I have put the coloured Bones of my Animals to ſeveral Proofs: Firſt, as Mr. *Belchier*, to that of boiling Water, and of Spirit of Wine, without the leaſt Change of Colour. It alſo reſiſted Soap-ſuds. A ſtrong Lixivium of Salt of Tartar diſcharged a little of the Colour, and made it look brighter. Vinegar made it take a yellowiſh brown and obſcure Tinge. In fine, Alum-water diſcharged the Colour pretty conſiderably, and the Water remained ſomewhat vinous. Thus theſe Bones perfectly well reſiſt the ſame Boilings as the Cloths dyed with the ſame Root; but the Air acts upon them much ſooner than on theſe Cloths: For the Bones of the Pullets in the Firſt Experiment, thoſe of the Turkeys in the Third, and thoſe of the young Pigeons, that had eat of the

*Madder* but Three Days, became intirely white in leſs than a Year; and the reddeſt Bones loſt much of their Colour. And I am of Opinion, that the Dew, to which I have expoſed ſome of them for a few Days, will finiſh the Whitening of them.

As there is a ſort of Analogy between the Nutrition of Animals and that of Vegetables, I have not neglected trying, if the Tincture of the *Rubia* would introduce itſelf into the Veſſels of ſome Plants: which would, perhaps, contribute much to lay open their Organization.

For the Firſt Experiment, in which indeed I had no Hopes of Succeſs, I planted Two Bulbs of Tuberoſes in Earth, with which I had mixed a good Quantity of *Madder*: But I found nothing, either in the Leaves, Stalk, or Flowers, but what was in the common and natural State. And this muſt have been ſo: For ſince it is only the Bones that take the Tincture in Animals, the Tuberoſe, having all its Parts ſoft, is in the State of an Animal without Bones: Such as a Leach, an Earth-worm, a Lamprey, which would probably continue in their natural State, whatever Quantity of *Madder* were given them, ſuppoſing it could poſſibly be done.

Wherefore I reſolved to try the Experiment on a Tree. I planted a Paradiſe Apple-tree in a Box, which I had filled with Earth mixed with a great deal of *Madder*; and I covered the Upper Surface of the Earth with a Layer of *Madder* Two Inches thick. This Layer was renewed ſeveral times for near Two Years that my Tree is under the Experiment; but I have not as yet been able to examine if its Wood is coloured by this Root. In caſe the Experiment does not ſucceed, as it is very likely it will not, it will ſerve at leaſt to expoſe the Vanity and Uſeleſſneſs of all thoſe Receipts and Proceſſes of Vegetation, that are to be found printed in *Mizaldus*, *Porta*, and other more modern foreign Compilers.

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## V. *A* Catalogue *of the* FIFTY PLANTS *from* Chelſea *Garden, preſented to the* ROYAL SOCIETY *by the Company of* Apothecaries, *for the Year* 1739. *purſuant to the Direction of Sir* Hans Sloane, *Bart. Med. Reg. & Soc. Reg. Præſ. By* Iſaac Rand, *Apothecary*, F. R. S. *Hort. Chel. Præſ. ac Prælec. Botan.*

851. ACarna major; caule folioſo. C. B. 379.

852. Aſtragalus, perennis hirſutus, Alopecuroides; Galegæ foliis; floribus luteis.

853. Bauhinia non aculeata; folio ſubrotundo, bicorni; floribus albis. D. Houſton.

854. Bidens Americana; flore albo radiato; foliis inferioribus trilobatis; ſuperioribus ſubrotundis, acute crenatis.

855. Bidens latifolia, hirſutior; ſemine anguſtiore, radiato. H. Elt. P. 51.

856. Bidens ſcabra; flore niveo; folio Panduræformi. Ibid. P. 54.

857. Bignonia Americana; Fraxini folio; flore amplo phœniceo. T. 164.

858. Bignonia Americana; Fraxini folio, minor; flore coccineo.

859. Calendula, minor, arvenſis. H. L. Bat.

860. Camara, Americana; Urticæ foliis, latioribus, ſpinoſa; floribus miniatis.

861. Camara, Americana; Urticæ folio; floribus miniatis.

862. Camara, Americana; Urticæ foliis minoribus; flore vario.

863. Camara Americana; foliis parvis ſubrotundis; floribus, foliolis interceptis.

864. Camara Americana; ſalviæ foliis, mucronatis; floribus luteis.

865. Caprifolium Germanicum. Dod. 411.

866. Chenopodio-morus media; foliis argute dentatis.

867. Chenopodium; Botryos folio, ſubtus candicante.
*Atriplex ſylveſtris.* II. Tab. Icon. 407.

868. Chenopodium; folio laciniato majus.
*Pes Anſerinus.* Fuſchii.

869. Chenopodium; folio ſinuato, candicante. T. 506.
*Atriplex ſylveſtris.* Tab. Icon. 406.

870. Chondrilla; Sonchi folio; flore luteo-palleſcente. T. 475.

871. Cirſium, arvenſe repens; folio vix ſinuato, in aculeum abeunte.

872. Cruciata nova, Romana, minima, muralis. Col. Ecph. 295.

873. Cynogloſſum, Virginianum; flore minimo, albo. Baniſteri. Pluk. Alm. 126.

874. Eryngium maritimum. C. B. 386.

875. Eryngium vulgare. Ibid.
*Eryngium campeſtre.* Dod. 730.

876. Jacobæa; foliis ferulaceis.

877. Lappa; ſive Bardana major; flore albo. H. Ox. III. 147.

878. Lappa major, ex omni parte minor; capitulis parvis eleganter reticulatis. Pluck. Alm.

879. Lilac; Liguſtri folio. T. 62.

880. Lyſimachia annua, minima; Polygoni folio. T. 142.

881. Mentha, anguſtifolia, ſpicata. C. B. 227.

882. Mentha, anguſtifolia altera, rugoſior; ſpica hirſuta.

883. Mentha, verticillata; longiori acuminato folio; odore aromatico.

884. Oldenlandia, humilis, Hyſſopifolia. Plum. N. G. 42.

885. Oxys, lutea, Americana, procumbens.

886. Pervinca vulgaris, anguſtifolia. T. 120.

887. Petaſites major, & vulgaris. C. B. 197.

888. Petaſites major; floribus albis; ſpica bipedali. D. Bobart.
*Petaſites major; floribus pediculis longis inſidentibus.* R. Syn. III. 179.

889. Petaſites minor; folio Tuſſilaginis. Mor. H. Reg. Bleſ.

890. Phlomis; acuminato, viridi, ſplendente folio; flore purpuraſcente; caulibus villoſis.

891. Phlomis, Hiſpanica, fruticoſa, candidiſſima; flore ferrugineo. T. 178.

892. Phlomis Narbonenſis; Hormini folio; flore purpuraſcente. Ibid.

893. Phytolacca; fructu monopyreno, majore; folio longiore, glabro.

894. Piloſella, major, umbellifera, macrocaulos. *Floribus eſt floſculoſis.* Col. Ecph. 248.

895. Roſa; Pimpinellæ folio, Scotica; flore eleganter variegato.

*Roſa Ciphiana.* Sibald. Scot. Illuſt.

896. Roſa ſylveſtris, Virginienſis.

897. Senecio Americanus; folio haſtato, nitide ſerrato.

898. Sium umbellatum, repens. Ger. Emac. 256.

899. Solanum, fruticoſum, Africanum; Lauri foliis.

900. Vulneraria erecta annua; folio ſubrotundo leviter crenato.

*Loto affinis, Coryli folio.* Dod. Mem.

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## VI. *A Phyſico-mathematical Demonſtration of the Impoſſibility and Inſufficiency of* Vortices: *By M.* de Sigorgne. *Tranſlated from the* French *by* T. S. *M. D.* F. R. S.

THAT natural Philoſophers of an inferior Claſs, who conſider only the Outſide of Things, are obſtinate in the Defence of *Vortices*, is, in my Opinion, not to be wondered at: The Idea of them ſtrikes the Mind very agreeably at firſt, and even ſeems to promiſe the true Mechaniſm. But that Perſons verſed in the moſt profound Geometry, and in the moſt ſublime Calculations, able Academicians, who inceſſantly apply themſelves to the Study of Na-

Nature, ſhould plunge headlong into theſe Notions, and ſuſtain the *Vortices pro aris & focis*, is to me Matter of unaccountable Surprize.

It appears to me, that a *Vortex* is as ſhocking upon mature Conſideration, as its Idea is ſatisfactory upon the firſt mentioning it. And *Vortices*, in my Opinion, are like ſmart Sayings *(bons mots)*, which charm the Mind the firſt, or, perhaps, the ſecond time, but by a Repetition become quite flat and inſipid. What Man, indeed, (if free from Prejudice, and that the Spirit of Party has not depraved his Judgment) would not be aſtoniſhed to ſee brought on the Scene, not only *Vortices*, but ſuch as are compoſed of an infinite Number of ſmaller *Vortices*, each of which ſtill contains an innumerable Number of others ſubordinate to them? For Example: What is this Air, this Water, this Oil, *&c.* which Monſieur *de Moliers* takes pains to introduce? A Sport of the Imagination, or of the Mind, if you pleaſe; but in reality a Paper-building. It has been long ſince ſaid, that according as *Vortices* ſhall be multiplied, they will degenerate into Littleneſs and Puerility: And theſe are the Sentiments even of the good *Carteſians* of our Days. But might it not be ſaid, that the great *Vortices* having the ſame Origin with the little, the latter ſhew the Meanneſs of Extraction of the former? As Matter is diviſible *in infinitum*; as to Vorticity, there is no Difference between the Great and the Small: And conſequently, we have a Right to reject the large *Vortices*, ſince *Carteſians* proſcribe the ſmall.

It is on this Conſideration that I am reſolved to attack the *Vortices*: For I muſt own, to the Shame of our Nation, that the Spirit of Party is ſo predominant therein, that ſeveral Perſons, who by a cloſe Study have found the Inſufficiency of *Vortices* for explaining the *Phænomena* of the Heavens, yet have not dared to publiſh their Notions on that Subject.

But as at preſent the Syſtem of ſmall *Vortices* is freely attacked, I think, as already ſaid, that I have a Right to attack the large; and to this Purpoſe I hope to prove,

I. That the mechanical Formation of a *Vortex* is impoſſible.

II. That the *Vortex*, were it formed, cannot be of long Duration.

III. In fine, that it is not ſufficient for explaining the *Phænomena*.

## FIRST PART.

### *The mechanical Generation of the* Vortex *is impoſſible.*

### DEMONSTRATION.

In the Hypotheſis of a perfect *Plenum*, GOD at firſt created Matter indefinite, uniform, homogeneous, and at Reſt. This is allowed by all *Carteſians*, and follows in their Principles from this alone, that Matter was created at Reſt. Now, from this perfect Homogeneity of Matter it evidently reſults, in my Opinion, that the *Vortex* cannot be mechanically formed. Suppoſe, ſay the *Carteſians*, that while Matter is as yet at Reſt, GOD imprints a Motion in a ſtrait Line on one of its Particles: This Particle will every Inſtant meet with Obſtacles to the rectilinear Motion in the encompaſſing Matter; this Motion muſt therefore be turned aſide, and will by this means become circular.

But why ſhould the encompaſſing Matter, which is at Reſt, be an Obſtacle to the rectilinear Motion? Becauſe, ſay they, it happens to be in the Line deſcribed by the Particle, on which Motion is ſuppoſed to be imprinted. But this very Reaſon would alſo prove, that the Body ſuppoſed to be in Motion could not circulate round a Centre at a Diſtance from it; becauſe it would conſtantly meet with Matter at Reſt in the Sides of the Polygon which it was to have deſcribed.

In a Word, it is a received Principle, that a Body which moves in a homogeneous Medium, never quits the Line of its firſt Direction: It does not refract, or deviate on one Side or the other of this Direction, except when it paſſes from an eaſier into a more difficult Medium, or from a denſer into a leſs denſe Medium: and even then its Direction muſt be oblique on the Surface of this Medium.

Now, the Body in Queſtion would move in a Medium intirely homogeneous; ſeeing all the created Matter is ſuppoſed to be ſo, and that all but one Particle of this Matter is at Reſt. It is moreover evident, that as all the Matter is uniform, every Direction, of what kind ſoever, of a Body which moves in the midſt of this Matter, will be perpendicular to the Surface which correſponds to it; as is demonſtrated in Mechanics. The ſuppoſed *Mobile* will therefore always move in the Line of its firſt Direction, until it has communicated all its Force; or rather it will remain at Reſt after the leaſt Shock, if Regard be had to nothing more than what I have hitherto ſaid.

But there ſtill remains a very important Remark to be made on this Subject, to wit, that as it is univerſally agreed at this Day, that Reſt is not a Force, all this Matter created at Reſt will be infinitely ſoft: Its Parts will have no Tenacity, no Connexion, no Viſcoſity; they will be but contiguous, and will not have more Adheſion to one another, than Two Globes which would touch out of the Bounds of the World without any reciprocal Attraction; ſince Tenacity, Viſcoſity, *&c.* are in the *Carteſian* Syſtem but the Effects of Compreſſion every Way. Wherefore theſe Parts will be divided at the leaſt Shock, in the ſame manner as if Quickſilver be thrown againſt a Wall, it is inſtantly ſeen to be divided into a Million of Parts, to be reflected on every Side, and be again divided as ſoon as it falls on the Floor. I know my Compariſon is not exact, but the Advantage is on my Side; becauſe Quickſilver is not without Viſcoſity, or a certain Tenacity between its Parts; whether it proceeds from Attraction, which is my Opinion, or that it be the Effect of the Preſſure of the ambient Fluid. Therefore the *Carteſian* Matter will have more Facility to divide than Quickſilver, and will not be ſuſceptible of any regular Motion; which alone demonſtrates, that the mechanical Generation of the *Vortex* is impoſſible.

There is however this Difference between the *Vortex* imagined by *Deſcartes*, compoſed of hard Globules; and that of the infinitely ſoft Matter of Father *Malebranche*, whoſe Syſtem is revived by his Diſciple Monſieur *de Molieres*; that if the *Carteſians* ad-

admitted Gravity as a Principle; beſides that it would give the true Cauſe of Hardneſs, its Combination with the ſtrait or projectile Motion would produce a Motion in a Curve; as Sir *Iſaac Newton* has demonſtrated. But until they will return to this Idea of primitive Gravity, and further while they will make uſe of no other Matter than one infinitely ſoft, and really unintelligible, it will not be poſſible to conceive a ſingle *Vortex* formed; far from having this infinite Number, which, by-the-bye, ought to be diſſipated as Waves raiſed in the Water, upon account of their perfect Homogencity.

The famous *Carteſians*, always refuſing to allow this primitive Gravity, and at the ſame time plainly ſeeing, that this firſt Manner of forming the *Vortex* was impoſſible, have had recourſe, in order to its Formation, to the Motion of Rotation of a ſolid Sphere at the Centre of a ſmall Particle of Matter at Reſt, *&c.* and they have pretended, that this Sphere in its Circulation ought to carry along with it the circumambient Matter.

But this Notion is certainly as unſuſtainable as the Firſt. For,

1*ſt*, They muſt explain to us the mechanical Formation of this Sphere; they muſt account for its Solidity: But all this manifeſtly ſuppoſes the *Vortex* already formed; all this ſuppoſes a Preſſure equal on every Side, uniform and concentric.

2*dly*, This Sphere would never imprint an equal Velocity on all the Points of the concave Surface which touches and incloſes it, ſeeing itſelf has not an equal Velocity in every Point of its laſt Surface; and therefore the *Vortex* would not have as much

Force to defend itſelf towards the Poles, as towards the Equator; as we ſhall ſhew hereafter.

*3dly*, This Sphere, in ſtriking againſt the ambient Matter, would but divide it *ad infinitum*; becauſe it is infinitely ſoft, and that its Parts have no Adherence with each other.

*4thly*, It is not ſufficient, that a Sphere turns round its Centre, to draw into its Circulation the ambient Matter: It is moreover requiſite, that to preſs on this Matter in a Direction from the Centre to the Circumference, (which a ſolid Globe either cannot do, or can hardly be conceived poſſible for it to do) and further ſtill, it is neceſſary there ſhould be Unevenneſſes on this Sphere, and on the concave Surface of the ambient Matter; becauſe otherwiſe, though the Sphere ſhould preſs this Surface by its centrifugal Force, it would only raiſe it up, or tend to raiſe it, and it would ſlide along the Surface without dragging it away with it: On which Head there is this Particularity to be remarked, that, for the uniform Circulation and Conſervation of the *Vortex*, and ſtill more for the preſerving of *Kepler*'s Laws, the Spheres and Surfaces muſt be ſtrictly Mathematical, as we ſhall ſoon ſee; and for its Formation they muſt be rough, and full of Unevenneſſes: But what can be more whimſical? And further, though theſe Surfaces were full of Prickles, yet could not the *Vortex* be formed in the Hypotheſis of Father *Malebranche*'s ſoft Matter; becauſe the Parts which would form theſe Eminences and Unevenneſſes on the concave Surface of the Matter ſurrounding the Sphere, not being connected with the other Parts of the ſame Matter, would be carried off without Difficulty by the Rotation of the Sphere; and the reſt of the Matter would remain at Reſt. And thoſe who would pretend, that theſe Unevenneſſes, theſe Parts which form the Hillocks we are ſpeaking of, could not, in conſequence of GOD's Decree, looſe themſelves from the other Parts of the Matter, would evidently abandon Mechaniſm, without reaping any Advantage: Becauſe, ſuppoſing it true, that by this Means the ambient Matter would be compelled to circulate, yet could it not form a fluid *Vortex*, wherein *Kepler*'s Laws could be obſerved; becauſe both the Sphere and theſe Surfaces being by theſe Unevenneſſes wedged into each other by ſolid hard and inflexible Parts, they would neceſſarily move all of a Piece, as the Parts of a Sphere do.

*5thly*, By means of this Sphere one could have but a great *Vortex* formed; and not that infinite Multitude of ſmall *Vortices*, with which the great ones are at this Day ſuppoſed to be filled, and in the Centre of all, or moſt Part of which, People will not allow that there are hard Globules, and ſo of the reſt: For I am perſuaded, that the Reader, by a little Meditation on this Subject, will find almoſt as many Reaſons againſt this Syſtem, as there are ſmall *Vortices* ſuppoſed to exiſt.

It may be objected, that we do not pretend to form a *Vortex*: We ſuppoſe that GOD formed it in the Beginning, and in Conſequence hereof we account for its Properties and Conſervation.

But, beſides that the Impoſſibility of the mechanical Generation of a *Vortex* is a ſtrong Prejudice againſt its Conſervation; I pretend, in the Principles of our Adverſaries, GOD could not form a ſingle *Vortex*.

I deſire Attention may be given, that a circular Motion is a redoubled and forced Motion; and not, as Mr. *Perault* thought, a natural Motion. Now the rectilinear Motion cannot be redoubled thus, as againſt its Nature, in order to become circular, but upon a Suppoſition that it meets in the ambient Matter invincible Obſtacles to its Direction; or that by a primitive Law it is carried towards a Centre by a Motion of Gravitation, at the ſame time that it receives a Motion in a ſtrait Line. Therefore, ſince on one hand this univerſal and primordial Gravity is obſtinately rejected; and on the other, as it is ſolidly proved above, that the ambient Matter is no Obſtacle to the rectilinear Motion; it remains certain, that the Formation of the *Vortex* is impoſſible. *Q. E. D.*

## SECOND *and* THIRD PART.

*The* Vortex, *though once formed, cannot laſt, and it is not ſufficient for explaining the celeſtial* Phænomena.

### POSTULATUM.

The cylindric *Vortex* cannot long ſubſiſt, and is not ſufficient for explaining the celeſtial *Phænomena*: This Principle is allowed by all *Carteſians* in both its Parts. It cannot ſubſiſt; becauſe not having Force to defend itſelf towards the Poles, if it happened to hit on that Side againſt another cylindric *Vortex*, that preſented its Equator, it would ſoon be broke into, and burſt to its very Centre. If, on the contrary, its ſame Side touched another cylindric *Vortex* by the Poles, they would both mix together, and would compoſe but one *Vortex*.

It is not ſufficient for explaining the celeſtial *Phænomena*; becauſe it is allowed, that the tranſlative Velocities of its Points cannot be in an inverted *Ratio* to the Roots of the Diſtances, and that its centrifugal Force does not diminiſh in the inverted *Ratio* of the Squares of theſe Diſtances, *&c.*

### COROLLARY.

Therefore the ſpherical *Vortex*, in order to be of Uſe, muſt have other Properties than the cylindric: That is to ſay, it muſt have a relative Force to one and the ſame Centre; for it is by this Force alone that it can be different from the cylindric *Vortex*.

This Force, moreover, muſt be equal in all the Points of the ſame ſpherical Superficies; becauſe otherwiſe it might be burſt and broke into in its weak Parts, as well as the cylindric, *&c.*

### THEOREM I.

Even in the ſpherical *Vortex* there is no relative Force to one and the ſame Centre: That is to ſay, that it has properly but an axifugal Force.

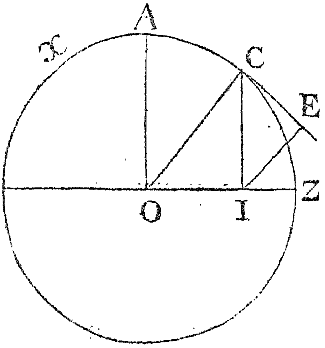
### DEMONSTRATION.

The ſpherical *Vortex* is compoſed, as well as the cylindrical, of ſeveral parallel Circles, but with this Difference, that in the ſpherical *Vortex* the *Radii* of the parallel Circles are not all equal, but on the contrary

trary diminiſh according as they recede from the Equator, and approach the Poles. Now it is manifeſt, that all the parallel Circles circulating round different Points of the Axis in the ſpherical *Vortex*, as well as in the cylindrical, tend to recede only from theſe different Points of the Axis, round which they circulate; becauſe a Body cannot tend to recede from any Centre but that of its Circulation. In a Word, in order to make a *Vortex* ſpherical, which was cylindrical, they have but proportionally ſhortened the parallel Circles. But let the *Radius* of a Circle be ever ſo much ſhortened or lengthened, that will not change the Direction of its dilatative Effort. I am miſtaken! an imaginary Line is going to change the Direction of the axifugal Force. This Force, as all agree, has for its Direction the *Radius* I C, in the Circumference whereof it is the *Radius*; but the Direction I C is oblique to C E the Tangent to the Sphere; therefore it changes, according to the general Law of an oblique Shock, into the Determination I E or O C relative to the Centre O.

But if Lines may be imagined, and that nothing more is requiſite to realize them, than Points that correſpond to them; we ſhall have ſome of all ſorts in the *Vortex*: We ſhall have oblique Lines on the *Radius* O A, a perpendicular one, and ſome more or leſs oblique, on the *Radius* I C, and by that means we ſhall be able to determine nothing. Let us grant however, that there is a Tangent to the Sphere C E, at the Point C, and let us ſee if it will be a ſufficient Reaſon for decompoſing the centrifugal Force I C into a central Force I E or O C. For that Purpoſe I ask, What are the Points that compoſe this Tan-

gent?



gent? It is evident, that it can only be the Globules of the upper *Stratum* that anſwer thereto. The Line CE is therefore compoſed only of a certain Number of Points ſeparate one from the other, and which conſequently can move one without the other. Therefore if the Line IC is perpendicular to the Globule that occupies the Point C, and that it paſſes through its Centre; there will be no Decompoſure, and the Force IC will not change into a Force that has the *Radius* OC for its Direction.

Now it is infinitely probable, that the *Radius* IC paſſes through the Centre of the Globule C; and it is eaſy to demonſtrate, that it is actually ſo even in the Principles of Monſieur *Saurin*, who firſt invented this central Decompoſition. For what has been the Cauſe of the Decompoſition of the circular Velocity into the centrifugal Force IC? It ſeems plain to me, that no other Cauſe can be aſſigned than the Point or Globule C; ſeeing there is but that one at the Point where it happened. The Line IC paſſes then through the Centre of the Globule C; ſince the De-

Decompoſition is always made in a perpendicular Line to the Point that cauſed it.

And indeed, either the *Radius* IC paſſes through the Centre of the Globule C, or the Centre of this Globule is on one Side or the other of this *Radius*, but ſo as that this *Radius* cuts the Point C; or elſe, it is a Space intercepted between Two Globules, which directly anſwers to the Point C. In the Firſt Caſe, there is no Decompoſition: In the Second, and in the Hypotheſis, that the Centre of the Globule C happens to be between the *Radius* IC and the Equator, there will be a Decompoſition; but it is manifeſt, that it will not be a central one: It will, on the contrary, be relative either to the very Pole, or to one of the polar Circles. In the Third Caſe, wherein it is ſuppoſed, that it is a Space intercepted between Two Globules, which anſwers to the Point C; there may be a Decompoſition, but it will be double, the one relative to the Centre O, and the other relative to the Pole Z.

Now the *Carteſians* can never draw from this Decompoſition the Advantage they propoſe; becauſe there will not be more Reaſon for heavy Bodies precipitating to the Centre of the Sphere by means of the central Force, than to the very Pole by the Aſſiſtance of the polifugal Force; or rather, the Complication of theſe Two Forces will compel the *Mobile* to precipitate to the Centre I of the Parallel it happens to be in.

Wherefore, in order to defend the ſpherical *Vortex*, they muſt ſay, that the Centre of the Globule C is comprehended between the Poles and the *Radius* IC. But on what Foundation will they aſſure it?

What are the Proofs they will give for it? One muſt certainly be a very bold Gameſter, to hazard this Point; becauſe beſides the Appearance of Truth, the Adverſaries of *Vortexes* may wager Three to One, that it does not ſo happen. But in caſe it be allowed, will they ever find in the ſoft Matter of Father *Malebranche* and Monſieur *de Moliere*, a ſufficient Cauſe of the Decompoſition? There muſt be a Reſiſtance to produce a Decompoſition, and an infinitely ſoft Matter does not reſiſt. And further, in the Hypotheſis of the Decompoſition of I C or O C, the *Vortex* would not be in Safety; becauſe there would be a Remainder of the centrifugal Force I C, that would be parallel to the Tangent C E, and would evidently ſpread Confuſion in the *Vortex*, by driving all the parallel Circles towards the Equator.

This ſeems to me ſufficient to diſcredit, in the Minds of rational People free from Prejudice, this central Force, which is attempted by all means to be introduced. But let us not be tired of examining this Point thoroughly: It is of Conſequence, and the *Carteſians* well deſerve the Trouble of an abundant Refutation. Wherefore let us ſuppoſe, that GOD forms a *Vortex* cylindrical and fluid; it is a received and evident Principle, that its Points will have but an axifugal Force. And if a Sphere be conceived to be inſcribed in this Cylinder, the Points that compoſe it, will not in like manner have any central centrifugal Force, according to the Axiom: *Noſtrum intelligere nihil ponit in re*. Now let us realize this ſpherical *Vortex*, which before we had but conceived; that is, let us ſuppoſe, that GOD has deſtroyed the tranſlative Velocity of the Points that form the

an-

angular Spaces intercepted between the laſt Surface of the inſcribed Sphere and that of the Cylinder; it is manifeſt, that no Change will happen in the Velocity and axifugal Force of the reſt of the Points, which are not included in theſe; for this Reaſon, that the Points which fill the Two kinds of Baſons that mark the Exceſs of the Cylinder above the inſcribed Sphere, remain in the ſame Order, Diſpoſition, and Direction, with regard to the inferior Points, which they were in at the time of their Motion. And there is no other Difference to be perceived herein, except that at preſent it is the ſame Point that conſtantly correſponds to the ſame Place; and that before this Place was ſucceſſively occupied by Points intirely reſembling each other, and that which remains or is ſuppoſed conſtantly to remain therein.

Now whether this Place be conſtantly occupied by one and the ſame Point, or ſucceſſively by Points intirely alike and in the ſame Order, is what ought not to produce any Variation in the Effect which we are examining: And this appears to me at leaſt as clear as Noon-day.

Wherefore, ſince theſe inferior Points had then but an axifugal Force, it follows that even now they have no other Tendency than to recede from the Centres of their Circulations, without having any Force relative to the Centre of the *Vortex*.

This is all that pure Reaſon dictates to me on this Point of the Nature of the *Vortex*, whether ſpherical or cylindrical: And I dare flatter myſelf, that whoſoever will attentively examine my Reaſonings, will find them as demonſtrative as can be deſired in Natural Philoſophy.

In Effect, Experience agrees here with Reaſon. If a glaſs Globe filled with Water be rapidly turned on its Axis, one ſees little Foulneſſes; the ſmall Atoms which it never fails to contain, gather together along the Axis, and form a little Cylinder round it.—— Which very plainly ſhews, that in this ſpherical *Vortex* of Water there is but an axifugal Force. *Q. E. D.*

## COROLLARY.

Therefore Gravity is inexplicable in the *Vortex*, and it has not Strength to defend itſelf towards the Poles.

## THEOREM II.

Suppoſing there was in the ſpherical *Vortex* a central Force according to the *Radius* O C, it could not by Reaction be changed into a centripetal Force according to the *Radius* C O.

This Propoſition is well known to all who are ſomewhat converſant in Mechanics.

It is therein demonſtrated, that if the *Radius* I C, for Example, forms with the Tangent C E an Angle of 45 Degrees, the Line of Reflexion will be parallel to the Axis; and that from the Point C to the Pole Z, the Lines of Reflexion will be divergent to the Axis; and, in fine, that from the Point C to the Equator, theſe ſame Lines of Reflexion will be indeed convergent to the Axis, but will never terminate at the Centre O: In a word, that becauſe the Angle of Reflexion is always equal to the Angle of Incidence, it is only at the Equator that the centrifugal Force can be changed into a centripetal Force. *Q. E. D.*

### COROLLARY I.

Therefore the modern *Carteſians* are ſtrangely miſtaken, when they pretend to account for Gravity by the Reverſe of the central centrifugal Force.

### COROLLARY II.

And they can never, *à fortiori*, in their Principles, explain the Figure of the Earth and of *Jupiter*, which are flatted Spheroids made by the Converſion of an Ellipſis upon its ſmall Axis.

### LEMMA I.

If the centrifugal Force repreſented by IC (ſee *p.* 420.) be decompoſed on the ſpherical Tangent into a Force, that for its Direction has the Centre of the Sphere; the central Force, which reſults from this Decompoſition, will be to the centrifugal Force, as the *Radius* IC to the *Radius* OC.

For the centrifugal Force IC, being decompoſed into C on the Tangent of the Sphere, will ſtrike this Tangent with a Force that will be repreſented by IE. But on account of the ſimular Triangles IEC, IOC; IE. IC : : IC. OC.

### LEMMA II.

A Body which deſcribes a Curve, ſtrikes this Curve every time it paſſes from one Side to the other, with an infinitely ſmall Force of the firſt kind with regard to its Velocity.

To the beſt of my Remembrance, this Propoſition is demonſtrated in Dr. *Clarke's* Notes on *Rohault's* *Phyſica*, and in Monſieur *de Moliere's* Lectures: And it is evident from this alone, that it can only be by a Force repreſented by the Sine of the Angle of Contact that this moveable Body ſtrikes the Tangent of its Curve.

## THEOREM III.

Let us put Complaiſance on the Stretch, and grant that *Vortexes* have a central and centripetal Force relative to one Centre O: I ſay, that the ſpherical *Vortex* will not have as much of this central Force, to defend itſelf towards the Poles, as towards the Equator.

## CONSTRUCTION.

Let us take, in the ſame Superficies X (ſee the Fig. *p.* 420.) Two Points at Pleaſure, the Point A in the Circumference of the Equator, and the Point C in the Circumference of a ſubduple parallel Circle; we will give in the Demonſtration an equal Velocity to the Globules which circulate in theſe Two Circumferences; which is the moſt favourable Conceſſion imaginable for the Patrons of *Vortexes*.

## DEMONSTRATION.

It is manifeſt, that if the Point A is in an equal Space of Time ſtruck an equal Number of Times as the Point C, and that each Stroke againſt the Point A be double each Stroke againſt the Point C; it is manifeſt, I ſay, that there is more Force at the

Equator than at the parallel Circle. Now the Suppoſition is very certain in both its Parts: For,

1. Since the Circumference of the Equator is the double of that of the parallel Circle, and that being at an equal Diſtance from the Centre O, (ſee Fig. p. 420.) the Globules they contain are equal to each other; if there be a Thouſand Globules in the Circumference of the Parallel, there will be Two thouſand in the Circumference of the Equator. And as theſe Globules are ſuppoſed to have in both an equal Velocity, they will make (but) One Revolution in the Equator, while thoſe of the ſubduple Circumference will make Two. Therefore, in both, there will be Two thouſand Strokes employed in the ſame Space of Time, againſt the Points A and C.

2. Each central Stroke is double at the Equator: Becauſe, as there is in both an equal Velocity, and that (Lem. II.) each centrifugal Stroke in every Circumference is a Fluxion of the firſt kind, with regard to the Velocity of the Globule which is in Motion; it follows that the centrifugal Strokes both in the Equator, and in the parallel Circle, are equal to each other. But the central Effort (which is the only one by which a *Vortex* can defend itſelf towards the Poles) is at the Point C (Lem. I.) but half the centrifugal Effort, ſince it is repreſented by IE ſubduple of IC; whereas at the Equator the central Effort is the ſame with the centrifugal Effort, becauſe the *Radius* OA is perpendicular on the ſpirical Tangent, which correſponds to it. Therefore, *&c.* *Q.E.D.*

### COROLLARY I.

Therefore if a *Vortex* be in *Æquilibrium* with another *Vortex*, and that the Equator of one happens to anſwer to the Poles or Tropics of the other; the latter will be burſt and penetrated to the Centre: And I do not think, that the *Carteſians* can find their Account in this Conſequence.

### COROLLARY II.

Therefore if the *Vortex* was the mechanical Cauſe of Gravity, Gravity ought to be greater at the Equator than at the Poles; and the Earth would be an oblong Spheroid; which is contrary to Obſervations.

### REMARK.

I have ſaid, that it was making a large Conceſſion to the *Carteſians*, to ſuppoſe that the Globules of both the Circumferences have an equal Velocity. For if a Sphere full of Water be made to turn on its Centre, Experience teaches, that the Velocity is greater at the Equator than in the parallel Circles; ſince it is obſerved, that the Times of their periodical Revolutions are equal. Whence it follows, that I have, in my Demonſtration, made the moſt favourable Suppoſition for the *Carteſians* that was poſſible.

### THEOREM IV.

In order to determine the Tendency of a Layer towards the Upper Part of the *Vortex*, regard muſt be had not only to that which reſults from its own Circulation, but alſo to that which it receives from the other lower Layers, unleſs it be the Layer next the Centre.

### DEMONSTRATION.

While a Layer is in Circulation, it viſibly makes a continual Effort towards dilating itſelf, by reaſon of the centrifugal Force, with which all its Parts endeavour to recede from the Centre of Circulation: But its actual Dilatation being impeded by the Layer next above it, this laſt will be naturally preſſed by it. And thus it is that the firſt or loweſt Layer, being put into Circulation, preſſes the Second; and the Second, aſſiſted by the Firſt, preſſes the Third; this, aſſiſted by the Two preceding, preſſes the Fourth; and ſo on from Layer to Layer, through the whole Extent of the *Vortex*. Whence it follows, that in order to eſtimate the Quantity of Force with which a Layer tends towards the Surface of the *Vortex*, one muſt take the centrifugal Force proper to this Layer and that, which all the Matter of the Fluid contained under it acquires by Circulation. *Q. E. D.*

### COROLLARY I.

Therefore the dilatative Effort of the Layers increaſes with the Layers in a greater Proportion than theſe Layers.

### COROLLARY II.

Therefore it is impoſſible to explain in the *Vortex*, how Gravity decreaſes in an inverted *Ratio* of the Squares of the Diſtances; and conſequently there will be nothing found in the *Vortex* to anſwer to

Attraction, whoſe Exiſtence Sir *Iſaac Newton* has ſo demonſtratively eſtabliſhed.

### COROLLARY III.

Thus we have re-eſtabliſhed in its full Light the Difficulty, which Monſieur *de Fontenelle* propoſed to Monſieur *Villemot* in the Memoirs of the Academy for the Year 1705 *. This learned Academician pretends, that as in the *Vortex* the lower Points ought to move faſter than the upper, in order to preſerve *Kepler*'s Aſtronomical Law; they ought alſo to have a greater centrifugal Force, and conſequently compel them to deſcend, particularly in proportion to their Fluidity. The Objection made a great Noiſe, and the only Method found of getting rid of it, was by ſaying, that although each lower Point had more centrifugal Force than each upper; yet as the *Vortex* was in *Æquilibrium*, and the Sums of the Force of each of the Two Layers were equal, there was no Reaſon why the lower *Stratum* ſhould get the better of the upper; becauſe this was as prevalent by the Number of its Points, as that was by the Force of each of its own.

But it is manifeſt, after what has been demonſtrated above, that the ſecond Layer, being aſſiſted by the firſt, muſt have a greater Force than the third, and conſequently compel it to deſcend, purſuant to the Principle then granted to Monſieur *Fontenelle*.

But if it be asked, How could the upper Layer deſcend, ſeeing Matter is impenetrable?

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* He afterwards publiſhed a Book, intituled, *Nouveau Syſteme*, ou *nouvelle Explication du Mouvement des* Planetes, *par M.* Philippe Villemot, *Pretre, Docteur en Theologie*, &c. *Lyon*, 1707. in 12°.

I ſhall aſk in my turn, How, in an intire *Plenum*, do heavy Bodies fall to the Centre? And I reaſon on the Principle granted to Monſieur *Fontenelle*.

But yet, becauſe what is allowed by one *Carteſian* is not always allowed by all; let us ſuppoſe, that the upper Layer cannot deſcend; this, at leaſt, will follow from my Demonſtration, that, according to the Principles of all theſe Gentlemen, an upper Layer being preſſed by all the under ones, it muſt haſten its Circulation, as long as it is ſlower than that of theſe under Layers; by reaſon that the Exceſs of their Velocities will act upon it, as if it had been at Reſt.

### COROLLARY IV.

Therefore the Layers of a *Vortex* will move all of a Piece, as do thoſe of a ſolid Sphere; and *Kepler's* Law cannot poſſibly be preſerved. We ſhall now give other Proofs upon other Principles.

### THEOREM V.

**The Motion of the Points of the Equator is abſolutely independent of the Motion of the parallel Circles; and conſequently, in order to determine the *Æquilibrium* of the Points of the Equator, we muſt attend to nothing but its Motion.**

### DEMONSTRATION.

The Plane of the Equator is parallel to the Planes of the other parallel Circles, that turn round the ſame Axe with it: Its centrifugal Force is perpendicular to the Tangent to the Sphere, which anſwers to it: It has not then any lateral Tendency towards theſe parallel Circles, and by a neceſſary Conſequence its Motion is abſolutely independent of theirs.

And indeed, if it be ſuppoſed, that the Motion of the other parallel Circles ſtops, there is ſtill ſome Motion conceived in the Equator, juſt as in the Caſe of the cylindrical *Vortex:* It is likewiſe conceivable, that the Velocity may be greater at the Equator than in the parallel Circles, as the Experiment already cited ſhews us: And if no Regard be had to the lateral Frictions, as the *Carteſians* would have it, who ſuppoſe them none or inſenſible, and as indeed they are obliged to ſay, that the *Vortex*, by the lateral Friction of the Equator, may not become cylindrical; this Equator will always continue to circulate uniformly, without communicating any of its Velocity to the Points that laterally ſurround it. Therefore, *&c.* *Q. E. D.*

### COROLLARY I.

Therefore for the *Æquilibrium* of the Points of the Equator, it is neceſſary, at leaſt, that an upper Circumference ſhould have as much Tendency towards the Superficies of the *Vortex*, as another under concentric Circumference; becauſe, if it had leſs, there would be no *Æquilibrium*, even in the Principles of the *Carteſians*; and the under Circumference, preſſing the upper, would either make it deſcend, or communicate to it a Force equal to its own. Wherefore, calling $F$ the proper centrifugal Force of a Point of the upper Circumference, and $f$ that of a Point of the under one; if S, s mark the different Sums of the Points contained in theſe Two Circumferences, we ſhall have $FS = fs$.

### COROLLARY II.

Therefore the centrifugal Force does not diminiſh in the Plane of the Equator in the inverted *Ratio* of the Squares of the Diſtances from the Centre; for ſince $FS = fs$; $F.f :: s.S$. But the Points being ſuppoſed equal on both Sides, their Sums are as the Circumferences, and one has $s.S. :: d.\mathcal{D}$, which gives $F.f :: d.\mathcal{D}$. inſtead of $:: dd.\mathcal{D}\mathcal{D}$.

### COROLLARY III.

Therefore *Kepler*'s Rules cannot be obſerved in the *Vortex*, or at leaſt in the Plane of its Equator; for ſince $F.f :: d.\mathcal{D}$; by putting in the Place of $F, f$, their Values, we ſhall have $\frac{VV}{D}.\frac{uu}{d} :: d.\mathcal{D}$, and therefore $V = u$ and $\mathcal{D}^2.d^2 :: TT.tt$. whereas we ought to have $V.u :: \sqrt[2]{d}.\sqrt[2]{D}$ and $\mathcal{D}^3.d^3 :: TT.tt$.

### REMARK.

There is here a *Fineſſe* of the *Carteſians* to be obſerved. Theſe Gentlemen conſider only the *Æquilibrium* of the ſpherical Layers of the *Vortex*, and from the Equality of their central Forces they deduce *Kepler*'s Laws, as well as they can.

But it is manifeſt, that whatever becomes of the Equality of Force in different ſpherical Superficies of the *Vortex*, there muſt be an *Æquilibrium* in the Plane of the Equator; becauſe it is in this Plane that the Planets move; and if there had not actually been an *Æquilibrium* between its Points, they would ſoon place themſelves there, by reaſon that Fluids always tend to the Side where they are leſs preſſed; and it is by an actual *Æquilibrium* alone that they are kept in their Places; which intirely overturns the Theory of theſe Gentlemen.

Let us however grant to the *Carteſians*, that the Sums of the Forces of the Two ſpherical Surfaces are equal; I cannot ſee, that they can thence infer, as they do, that the central Force diminiſhes in a reciprocal *Ratio* of the Square of the Diſtance from the Centre. Let us examine their Argument:

$FS = fs$, ſay they; therefore $F.f :: s.S$; but $s, S$ mark the Sums of the Points contained in the Two Surfaces; therefore they are as theſe Surfaces, which, being as the Squares of their Diſtances, give, $F.f :: dd.DD$.

But it muſt be remarked, that the Surfaces of the *Vortex* are not Mathematical, they are Surfaces which have ſome Thickneſs: They cannot then be proportional to the Squares of their Diſtances from the Centre, except in the Caſe when their Thickneſs is equal. Now, according to the *Carteſians*, the Points or Globules, which compoſe the *Vortex*, increaſe in Bulk according as they recede from the Centre; and, beſides, they are homogeneous, or of an equal ſpecific Denſity, at leaſt in their common Syſtem. And conſequently it is certain, that the different natural or real *Strata* of the *Vortex* are not of an equal Thickneſs, and that the Matter contained therein is not proportionate to the Squares of the *Radii* of theſe Surfaces, but only to the Squares of theſe *Radii* multiplied by the Thickneſs of the *Strata*. Therefore, *&c.* *Q. E. D.*

## COROLLARY IV.

Therefore, even allowing the *Carteſians*, what one has a Right (COROL. I. THEOR. IV.) to refuſe them, they will never be able to explain *Kepler*'s Rules in the *Vortex*; for it is only by the Proportion, which I have juſt now annulled, that they pretend to do it. See M. *de Molieres*'s *Leçons de Phyſique*.

And if it be objected, that I have not, in the preceding Corollaries, had any regard to the Thickneſs of the Circumferences; I anſwer, that it was by way of pure Conceſſion that I have not done it; and if any Perſon will be at the Pains of doing it, he will eaſily find, that *Kepler*'s Rules will only be the more diſturbed thereby.

## CONCLUSION.

Therefore the *Vortex* is every way impoſſible, and inſufficient in Natural Philoſophy. Its mechanical Generation is impoſſible (PART I.); it has only an axifugal Force, and not a centrifugal and centripetal Force, as it ſhould have (THEOR. I. and II.); and even if it had, it cannot (THEOR. III.) defend itſelf equally on all Sides. It is not ſufficient for explaining Gravity, and its Properties; it deſtroys *Kepler*'s Aſtronomical Laws (COROL. III. THEOR. IV. and V.). What more can be deſired, in order to conclude with Sir *Iſaac Newton*? "Itaque hypotheſis Vorticum "(eſt impoſſibile &) cum phænomenis aſtronomicis "omnino pugnat, & non tam ad explicandos quam "ad perturbandos motus cœleſtes conducit." *Q.E.D.*

## VII. *An Account by* David Hartley, *M. B.* F. R. S. *of Dr.* Trew's *Diſſertation concerning the Differences of a Human Body before and after Birth, intituled,* Diſſ. epiſtolica de differentiis quibuſdam inter hominem natum & naſcendum intervenientibus, deque veſtigiis Divini Numinis inde colligendis. *Jo. Georgio Kramero* inſcripta. Cum Tab. Æn. Autore *Chriſtoph. Jacobo Trew, Noribergiæ,* 1736. 4to.

THERE are, according to Dr. *Trew*, Two remarkable Obſervations, which Animal Bodies ſuggeſt, 1*ſt*, That the ſame general Ends are accompliſhed in different Animals by all the poſſible Varieties of Means. 2*dly*, That Animal Bodies are Machines, which produce in themſelves all thoſe Changes, that are neceſſary for their Preſervation and Well-being. Thus the ſame general Ends of Chylification, Circulation, Secretion of Bile, *&c.* are accompliſhed in different Animals by Organs that differ conſiderably from each other; and in the ſame Animal the Body of the *Fœtus* is very different in its Structure from that of the Adult, at the ſame time that this Difference is effected by the Body itſelf, each ſubſequent Variation, the natural and mechanical Conſequence of that which immediately preceded, and the Whole conducted in the beſt poſſible manner for the Welfare and Happineſs of the Animal.

The Author's Deſign in this Diſſertation is to conſider thoſe Differences of a Human Body before and after Birth, which affect the Circulation of the Blood. And for this Purpoſe he has given us 78 very curious and accurate Figures of the Parts relating thereto, ſuch as the Heart, and Trunks of the great Blood-veſſels, the Liver, the *Vena Portarum*, the Umbilical Chord, *&c.* ſubjoining to them a very minute and preciſe Explanation of each. Some of theſe Figures repreſent the Parts as they appeared immediately upon Diſſection, others as inflated and dried, others again as injected with Wax; and laſtly, others as having been firſt injected, and well dried, then cleared of the Injection, and laid open, in order to ſhew the ſeveral Cavities and Valves in their natural Dimenſions and Poſitions. This laſt Method he prefers to all the reſt, and obſerves, with relation to it, that the Injection muſt not be thrown in too hot, and that the internal Parts of the Preparation muſt be perfectly dry before we attempt to evacuate it; inaſmuch as a Neglect of either of theſe Cautions would make the Valves, and their Membranes, ſhrivel up and contract themſelves from their natural Sizes and Poſitions. The Manner of doing it is to ſuſpend the Preparation in a proper Veſſel placed in a gentle Heat, having firſt made an Aperture in the moſt depending Part, for the Injection to run out at.

From theſe Figures, with their Explanations, our Author draws the following Anatomical and Phyſiological Concluſions.

1*ſt*, That, contrary to *Caſſerius*'s Figure, the Umbilical Vein enters the Liver towards the Left Part of it.

2*dly*, That the Sulcus of the Liver, through which the Umbilical Vein paſſes, is not always the ſame. In ſome Subjects it ſurrounds the Vein along its whole Paſſage, in others only in Part of its Paſſage, and in others it is an imperfect Chanel, which merely receives the Vein.

3*dly*, There is but one Umbilical Vein, it empties itſelf into the Left Extremity of the *Sinus Venæ Portarum*, and ſends no Branches to the Liver.

4*thly*, The Communication between the Umbilical Vein, and the *Sinus Venæ Portarum*, is ſo free, that the Blood has no Obſtacle in paſſing either Way. Our Author asks therefore, What is the Cauſe of the Blood's Motion from the Umbilical Vein into the Liver, and whether the Pulſation of the Umbilical Arteries be one ſufficient to produce this Effect?

5*thly*, The *Venæ Portarum* ſends no Branches to the Liver, but opens into a particular *Sinus*, called *Sinus Venæ Portarum*; and this Opening is nearer to the Right Extremity of the *Sinus* than to the Left.

6*thly*, The Diameter of the *Venæ Portarum* is much leſs than that of the Umbilical Vein. The Diameter of the Left Part of the *Sinus Venæ Portarum* is generally larger than both theſe together, never much leſs than that of the Umbilical Vein; and the Diameter of the *Canalis Venoſus* is leaſt of all. The Blood therefore of the *Venæ Portarum* mixes with that of the Umbilical Vein in the *Sinus*. And ſince the Blood of the Umbilical Vein, which abounds with chylous Particles, does thus mix with that of the *Venæ Portarum* in the *Fœtus*, it may be asked, Whether in Adults the Branches of the *Venæ Portarum*, which ariſe from the Stomach and Inteſtines,

teſtines, do not ſuck up ſome chylous Parts from the Aliment? And whether both in the *Fœtus*, and in the Adult, Chyle be not a neceſſary Ingredient in the Compoſition of Bile? It is certain, that the Chyle paſſes into the *Vena Portarum* in Birds.

*7thly*, The *Canalis Venoſus* empties itſelf into the *Cava Inferior*, where the Three Veins ariſing from the Liver empty themſelves.

*8thly*, The *Valves* which are placed at the Two Extremities of the *Canalis Venoſus*, facilitate the Aſcent of the Blood in it, and alſo contribute to cloſe it after Birth.

*9thly*, The *Valve* of the Coronary Vein is nothing elſe but its external Coat, ſomething elongated within the Cavity of the Right *Auricle*; and its Uſe is to cloſe the Orifice of this Vein when the *Auricle* is diſtended with Blood, juſt as the nervous Coat of the Bladder cloſes the Orifices of the Ureters when the Bladder is diſtended with Urine.

*10thly*, *Euſtachius*'s *Valve* is found both in the *Fœtus*, and in the Adult; and its Uſe ſeems to be, to direct the Blood's Motion variouſly, according to the various Circumſtances of the Right *Auricle*, during its *Diaſtole* and *Syſtole*; and principally to hinder the Regreſs of the Blood into the *Cava Inferior*, when the *Auricle* is contracted.

*11thly*, The Uſe of the *Foramen Ovale*, and *Canalis Arterioſus*, ſeems to be, to intercept Part of the venal Blood, and tranſmit it to the Left *Auricle* and *Aorta*, that ſo the Whole be not forced upon the Lungs during their State of Inactivity in the *Fœtus*; of the Membrane, which is placed before the *Foramen Ovale*, to direct the Communication of the

*Auricles* before Birth, and prevent it afterwards; and laſtly, of the valvulous Productions at the Two Extremities of the *Canalis Arterioſus*, in like manner to direct the Blood in its Motion through this Canal before Birth, and to exclude it afterwards. Here our Author enters into a very minute Examination of Monſieur *Mery*'s Hypotheſis, but does not agree to it; affirming, that the Membrane of the *Foramen Ovale* is ſo placed as to permit the Blood to paſs freely from the Right *Auricle* to the Left, during the *Diaſtole* of the *Auricles*, but never from the Left *Auricle* to the Right.

12*thly*, The Uſe of the *Urachus* in the human *Fœtus* is not yet diſcovered. Our Author here ſuppoſes, according to the Determination of the beſt Anatomiſts, that the human *Fœtus* has no *Allantoïs*.

13*thly*, The Situation of the Stomach in the *Fœtus* is ſuch, as makes up for the want of Action in the *Diaphragm*, as far as relates to Digeſtion. For as in the Adult, the Action of the *Diaphragm* facilitates the Deſcent of the Aliment, ſo in the *Fœtus* the *Cardia* is made to riſe above the *Pylorus* more than in the Adult, from its Connexion with the *Diaphragm*, for the ſame Purpoſe.

14*thly*, The Smallneſs of the Stomach in new-born Children ſhews, that it ought not to be oppreſſed either with much Aliment at once, or with ſuch as is groſs.

15*thly*, The Deſcent of the *Teſticles* into the *Scrotum* does not always happen at the ſame time.

16*thly*, The recurrent Nerve ſeems to be ſome way ſubſervient to the *Canalis Arterioſus*. This our Author conjectures from its paſſing round the *Aorta* juſt where this receives the *Canalis Arterioſus*; but obſerves, that the Knowledge of the Uſe and Action of the Nervous Syſtem is much more imperfect than any other Branch of the Animal Oeconomy.

*There is a ſhort Diſſertation (with Four Figures of the Tongue, its Veſſels, Glands, Muſcles, and Nerves annexed) by the ſame Author; whoſe principal Intent is to ſhew, that the Veſſels called ſalival Ducts by* Coſchwitzius, *are not ſalival Ducts, but Veins.*

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## VIII. *Some curious* Experiments *and* Obſervations *on a* Beetle, *that lived* Three Years *without Food: Communicated to the* ROYAL SOCIETY *in a Letter from Mr.* Henry Baker *to* Alexander Stuart, *M. D.* F. R. S.

*SIR,*

WHEN I had the Honour of waiting on you lately, and was mentioning, in Converſation, the uncommon and ſurpriſing Strength of Life beſtowed by Providence on a certain *Engliſh* Inſect, called by *Petiver*, *Scarabæus impennis tardipes*, the ſlow-legged *Beetle*. *Moff.* 139. Fig. id. Angl. 999. *Gaz.* Decad. 3$^{æ}$, Tab. XXIV. 7. (whoſe Natural Hiſtory, as to that Particular, has never, I believe, been touched on) you was pleaſed to think it ſo extraordinary, as to deſire I would write down the Obſervations I had made, ſince the Accidents that led me into them may perhaps never again occur: And you ſeemed of Opinion, that their being known may open a Way to more amazing Diſcoveries, and tend conſiderably towards inlarging our Notions of Animal Life in general.——In Obedience therefore to your Commands, I preſume to lay before you a Series of plain Facts, without troubling you with my own Reflections, or endeavouring to ſet them off with any other Ornament than Truth.

In the Middle of the Month of *June* 1737. I happened to be at a Relation's Houſe at *Tottenham* in the County of *Middleſex*; and whilſt I was there, a large Ciſtern of Lead, that was placed in the Coach-houſe-yard, to receive by Pipes the Rain-water from ſome Out-buildings, fell down, through the Failure of a wooden Frame whereon it ſtood. My Curioſity led me to examine into this Ciſtern; and at the Bottom of it, I obſerved ſeveral black *Beetles*, plunging in a muddy ſlimy Sediment, which the Water had left. Taking out Two or Three of them, I found them of a middling Size, ſomewhat above an Inch in Length, having Six pretty long Legs, with Two little Hooks at the Extremity of each, in the Manner of the common *Beetles*: They were all over of a ruſty black Colour, with *Antennæ* long and jointed; a Body covered with one ſtrong Shell, forming an Appearance of Caſe-wings, but undivided, and without any filmy Wings underneath, and a Tail turning up a little: In ſhort, they reſemble very much a Sort of *Beetle* that is ſometimes ſeen in Houſes, but were of a ſtronger and much more firm Contexture.

As I have preſerved moſt of our *Engliſh* Inſects, (after a Manner I ſhall not here take up your Time in deſcribing) I choſe one of the largeſt of theſe *Beetles*, and threw it into a Cup full of common *Lamp-ſpirits*, (that being the Way of killing and preparing them for my Purpoſe) and in a few Minutes it appeared to be quite dead: Whereupon I ſhut it up in a round Pill-box of about an Inch and half Diameter, and carried it in my Pocket next Day to *London*, where I toſſed it into a Drawer, and thought no more of it for above Two Months after; when, opening the Box, I found it, to my great Surprize, alive and vigorous; though it had nothing to eat for all that Time, nor received any more Air than what could be met with in ſo ſmall a Box, whoſe Cover ſhut very cloſe. Having, however, no Intention of keeping it alive, I again plunged it into *Spirit* of *Wine*, and let it lie conſiderably longer than the Firſt time, till ſuppoſing it dead beyond any Poſſibility of Recovery, I put it into the ſaid Box again, and locked it in my Drawer, without looking any more at it for a Month at leaſt, when I found it again alive.———And now I began to imagine there muſt be ſomewhat extraordinary in this Creature, ſince it could ſurvive the Force of *Spirit* of *Wine*, which ſoon kills moſt other Inſects, and live for Three Months, without taking in any Suſtenance.

A few Days before this, a Friend had ſent me Three or Four *Cock-Roches*, or as *Merian* calls them, *Kakkerlacæ*, brought alive from the *Weſt-Indies*: Theſe I had placed under a large Glaſs of Six or Seven Inches Diameter, made on purpoſe to obſerve the Transformation of *Caterpillers*: And now I put my *Beetle* amongſt them, that he might enjoy a greater Share of Liberty than he had done for Three Months before. I fed them with green *Ginger* moiſtened in Water, and they eat it greedily; but I

could

could not find, nor do I believe, that the *Beetle* ever taſted it during the whole Five Weeks they lived under the Glaſs together. I often took notice, that the *Cock-Roches* would avoid the *Beetle*, and ſeem frighted at his Approach; but never obſerved any Tokens of his Liking or Diſlike of them, for he uſually ſtalked along, without regarding whether they came in his Way or not. Perceiving the *Cock-Roches* begin to decline in Vigour, I was afraid they would loſe much of their Beauty, if I permitted them to die of Sickneſs, and would become unfit to be preſerved as I propoſed: Wherefore I put them into *Spirit* of *Wine*, and the *Beetle* their Companion with them. They appeared dead in a few Minutes, and I believe were really ſo: The *Beetle* ſeemed likewiſe in the ſame Condition: Whereupon, after they had lain in *Spirits* about an Hour, I took them out, and whelmed the Glaſs over them, till I ſhould have Leiſure to diſpoſe of them as I intended. This was about Ten o'Clock in the Morning, and I ſaw them no more till Evening, but found the *Beetle* then creeping about as ſtrong and vigorous as ever: And therefore I reſolved to put him to a Trial I imagined he could not poſſible ſurvive, which was to let him remain a whole Night in *Spirits*; but here too I found myſelf miſtaken, for after he had been taken out a Day, he appeared as lively as if nothing had happened to him.

Since that time I have put him no more in *Spirits*, but have kept him under the Glaſs afore-mentioned, where he is alive at preſent: Though during the Two Years and half he has been in my Poſſeſſion, I have never been able to diſcover, that he has drank or eaten any thing.

I muſt not conceal, however, that, by way of Experiment, I have put under his Glaſs, at different times, Water, Bread, Fruits, *&c.* but I never found them in the leaſt diminiſhed or touched by him. Theſe Trials too were always made at many Months aſunder, and I am pretty certain, there has been at leaſt a Year together, during ſome Part of the aforeſaid Time, wherein nothing has been offered him either to eat or drink.

The Queſtion will then be, How this Creature has been wonderfully kept alive for Two Years and an half, without taking any viſible Food?——And, Sir, your Suppoſition, that it finds its Nouriſhment in the Air, carries with it the higheſt Probability: Since, as you was pleaſed to obſerve, there are Particles in the Air which evidently ſupply a Growth to Plants of ſome particular Kinds, ſuch as the *Sempervive, Orpine, Houſe-leek, &c.* And the ſame or ſome other Particles therein contained may poſſibly be likewiſe able to afford a Nouriſhment to Animals of ſome certain Kinds.——There is a farther Reaſon alſo to believe, that ſomething like this muſt be; for, in the amazing Plan of Nature, the *Animal*, *Vegetable*, and *Mineral* Kingdoms are not ſeparated each from other by wide Diſtances, or broken off by ſudden Starts, but differ from each other (near their Boundaries) by ſuch minute and inſenſible Degrees, that it is impoſſible to find out certainly where the one begins, or where the other ends.——As the Air, therefore, yields Nouriſhment to ſome Kinds of Plants, it may probably do the ſame to ſome Kinds of Animals; for otherwiſe a Link would ſeem wanting in the mighty Chain of Beings.——And that *Chameleons*, *Lizards*, *Snakes*,

*&c.* can live for Months together without any viſible Suſtenance, is a Fact generally allowed to be true; the Cauſe of it too has been attributed to an exceeding ſlow Digeſtion, Circulation, and Diſtribution of Nouriſhment, in thoſe Creatures; but as their Agility ſeems to imply a brisk Motion of their *animal Spirits*, I am inclined to think the Circulation of their other Fluids cannot be ſo ſluggiſh as commonly is ſuppoſed: And, perhaps, it may not be unreaſonable to believe, that their being able to live ſo long without viſible Food, is rather owing to ſome other Nouriſhment they receive from the Air, which ſupplies the want of more ſubſtantial Diet.

I have met with no Inſtance I could give Credit to, of any Creature's living without Food for ſo long a time as the *Beetle* I have been mentioning; and yet I doubt not, (though it may have been kept alive by Air only) but that, in its natural State, it eats more ſolid Food; after ſomewhat the ſame manner as the Plants before-named thrive beſt when ſet in a little Earth, notwithſtanding they may flouriſh a long while, and ſend forth Branches and Flowers, when they are ſuſpended in the Air, and receive no Nouriſhment but from the Humidity or ſome other Qualities thereof.

We have not, indeed, as yet, many Inſtances of this Sort in Animals; nor is it probable any of the larger Kinds can live long without Supplies of Food: But there may be ſeveral Inſects capable of ſubſiſting on minute Particles carried about every-where with the Air, though, for want of ſufficient Experiments, we are not acquainted with them.

Its reviving ſo often after being ſeemingly killed by *Spirit* of *Wine*, ſhews a Strength of Life I never found in any other Inſect: Some Kinds, indeed, will come to Life again, if taken out as ſoon as they appear dead; and the *Ear-wig*, in particular, after continuing ſo ſome Minutes: But half an Hour in *Spirits* puts a final End to the Life of all the *Inſects* I ever tried, except this *Beetle*.

It walks not much about under the Glaſs that covers it, but is uſually found with its Noſe thruſt cloſe down to the Bottom thereof, perhaps to ſuck in the Air. On removing the Glaſs, it appears robuſt and vigorous, and would willingly run away. A ſtrong aromatic kind of Smell iſſues from it, agreeable enough when there is not too much of it; and the ſame Scent hangs about the Fingers a long while after touching it.——Since the Weather has been ſo exceſſive cold, it is grown ſomewhat torpid; but till now has always appeared as lively in cold as in hot Weather, and I have obſerved its Smell to be ſtronger in Winter than in Summer. In the exhauſted Receiver, where I have kept it ſometimes for half an Hour, it ſeems perfectly unconcerned, walking about *in Vacuo* as briskly as in the open Air; but, upon Admiſſion of the Air, it ſhrinks its Legs together, and appears in a Surprize for near a Minute.

We know the *Egyptians* had a high Veneration for the *Beetle*, by their many Images thereof, which are ſtill preſerved in the Cabinets of the Curious, and Hiſtorians tell us it was one of their Deities: But, as the *Egyptians* were a wiſe and learned People, we cannot imagine they would ſhew ſo much Regard to a Creature of ſuch a mean Appearance, without ſome extraordinary Reaſon for ſo doing:

And is it not poſſible they might have diſcovered its being able to ſubſiſt a very long time without any viſible Suſtenance, and therefore have made it a Symbol of the Deity? In the ſame Manner as it is probable the *Onion* was held ſacred by them, for repreſenting the *Orbits* of the *Planets*.——But theſe Conjectures may ſeem impertinent to one ſo uſed to curious Diſquiſitions, and therefore I ſhall not dare intrude on your Time any longer, than to profeſs myſelf, with the greateſt Reſpect,

*SIR,*

*Your moſt humble Servant,*

Strand, Jan. 2. 1739-40. **H. Baker.**

*P.S.* This *Beetle* (after being kept half a Year longer) was permitted to get away, by the Careleſſneſs of a Servant, who took down the Glaſs to wipe it.

*See the* Figure *of this* Inſect, *in* TAB. II. Fig. 1.

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## IX. *The Diſcovery of a perfect Plant in* Semine; *by Mr.* Henry Baker.

SINCE the antient Suppoſition of *equivocal Generation* has been rejected, for a more reaſonable Belief, that every Thing proceeds from Parents of its own Kind, Numbers of curious People have buſied themſelves in Search of Experiments, whereby to demonſtrate the Truth of the latter, and conſequently the Falſity of the former Opinion. For this Purpoſe the *Animal* and *Vegetable* Worlds have been examined, and ſuch Analogy found between them, as proves convincingly, that their *Generation* and *Increaſe* are brought about in a Manner pretty much alike. The animal and vegetable *Semina* are found to be alike the *Rudiments* of their future Offspring; and both alike require only a proper Repoſitory to preſerve them from Injuries, and proper Juices to advance their Growth, and bring them to Perfection.

Glaſſes (which the Moderns have ſo much improved) are the Means whereby theſe Secrets in Nature are diſcovered to us. The Eye, aſſiſted by a good Microſcope, can diſtinguiſh plainly, in the *Semen maſculinum* of Animals, Myriads of *Animalcules* alive and vigorous, though ſo exceedingly minute, that it is computed three thouſand Millions of them are not equal to a Grain of Sand, whoſe Diameter is but the one hundredth Part of an Inch: And the ſame Inſtrument will inform us beyond all Doubt, that the *Farinæ* of Vegetables are nothing elſe but a Congeries of minute *Granula*, whoſe Shapes are conſtant and uniform as the Plants they are taken from. And as the Seeds of Plants are found by repeated Experiments to be unprolific, if the *Farina* be not permitted to ſhed, it has been ſuppoſed, that all its *Granula* contain *Seminal Plants* of their own Kind.

The *Growth* of Animals and Vegetables ſeems to be nothing elſe but a gradual Unfolding and Expanſion of their Veſſels by a ſlow and progreſſive Inſinuation of Fluids adapted to their Diameters, until, being ſtretched to the utmoſt Bounds allotted them by Providence at their Formation, they reach their State of Perfection, or, in other Words, arrive at their full Growth.——If this be granted, the Conſequence muſt be, that all the Members of a perfect Animal *exiſt* really in every *Animalcule* of the *Semen* *animale maſculinum*, and all the Parts of a perfect Plant in every *little Grain* of the *Farina Plantarum*, however minute either of them may be.

According to this *Theory*, it is ſuppoſed by ſome, that, in *Animals*, the *Semen* of the Male being received into the *Matrix* of the Female, ſome of the *Animalcules* it contains in ſuch Abundance, find an Entrance into the *Ovaria*, and lodge themſelves in ſome of the *Ova* placed there by Providence as a proper *Nidus* for them. An *Ovum*, becoming thus inhabited by an *Animalcule*, gets looſened in due time from its *Ovarium*, and paſſes into the *Matrix* through one of the *Fallopian Tubes*. The Veins and Arteries that faſtened it to the *Ovary*, and were broken when it dropped from thence, unite with the Veſſels it finds here, and compoſe the *Placenta*: The Coats of the *Ovum*, being ſwelled and dilated by the Juices of the *Matrix*, form the *Chorion* and the *Amnion*, Integuments needful to the Preſervation of the *little Animal*, which, receiving continually a kindly Nouriſhment from the ſame Juices, gradually ſtretches and inlarges its Dimenſions, becoming then quickly viſible with all the Parts peculiar to its Species, and is called a *Fœtus*.

In *Plants*, ſay they, (which are uncapable of removing from Place to Place, as Animals can) it was requiſite a *Repoſitory* for their *Farina* ſhould be near at hand to prevent its being loſt; and accordingly we find, that almoſt every Flower, producing a *Farina*, has likewiſe in itſelf a proper *Ovary* for its Reception; where the *Ova* thereby impregnated are expanded by the Juices of the *Parent Plant* to a certain Form and Bulk, and then, becoming what we call *ripe Seeds*, they fall to the *Earth*, which is a natural *Matrix* for them.

According to the above Suppoſition, a *ripe Seed*, falling to the Earth, is in the Condition of the *Ovum* of an Animal getting looſe from its *Ovary*, and dropping into the *Uterus*: And, to go on with the Analogy, the Juices of the *Earth* ſwell and extend the Veſſels of the *Seed*, as the Juices of the *Uterus* do thoſe of the *Ovum*, till the *Seminal Leaves* unfold, and perform the Office of a *Placenta* to the Infant included Plant; which, imbibing ſuitable and ſufficient Moiſture, gradually extends its Parts, fixes its own Root, ſhoots above the Ground, and may be ſaid to be born.

Others diſapprove of this *Hypotheſis*, and inſiſt that no *Animalcule* can poſſibly enter the *Ovum animale*, nor any Particle of the *Farina* get into the *Embryo* of a Seed: But, ſay they, in Animals, either the fineſt Part of the *Semen* is taken in by the Veſſels of the *Vagina* and *Uterus*, circulated with the Fluids, and carried into the *Ovaria*, and even into the *Ova*, by the Veſſels that run thither; or elſe, Fecundation is occaſioned by a *ſubtile Spirit* in the *Semen maſculinum*, which paſſes the *Uterus*, enters the *Ovaria*, pervades the Female *Ova*, actuates and enlivens the *ſeminal Matter* in them contained, and produces all the various Symptoms of Conception:——In Plants too, ſay they, the ſame is effected by penetrating *Effluvia* from the *male Semen* or *Farina*.

This Account of animal and vegetable Generation is intended to introduce a Diſcovery, which may poſſibly ſome way lead to a greater Certainty about it.

Amongſt numberleſs Inquirers, whom the Opinion, that every Seed includes a real Plant, has ſet at work to open all Kinds of Seeds, and try by Glaſſes to find evident Proofs thereof, I have not been the leaſt induſtrious: But after repeated *Experiments*, in every Manner I could think of, and with the utmoſt Nicety in my Power, I began to deſpair of ever attaining an ocular Demonſtration of it. If by moiſtening the Seed it began to vegetate, I could indeed diſcern the *ſeminal Leaves*, and the *Germen* or *Bud*, whence the future Plant ſhould ariſe; but was able to go no further, unleſs I waited till the Moiſture gradually extending its Veſſels made the little *Root* ſhoot down, the *Stalk* riſe up, and the *minute Leaves* expand, and bring themſelves to View. This, however, was not the Thing I ſought for: But, ſome Days ago, mere Accident, when I thought nothing about it, favoured me with a Diſcovery I had ſo often ſearched after to no purpoſe.

Endeavouring with a fine Lancet to diſſect a Seed of the *Gramen tremulum*, (a Seed whereof is placed in the Hole, marked Fig. 1. of the Ivory Slider herewith preſented, and as it appears in Tab. II. Fig. 2. prefixed to this *Tranſaction*) with Intention to examine the ſeveral Parts of it with a Microſcope, imagining I might find ſomewhat curious in the Contexture of its Husk, the Edges of which I obſerved to be tranſparent, I opened it the long Way exactly in the Middle, and took notice of ſomething exceeding ſmall between the Two Sides, which I had ſeparated. I ſtuck the Point of the Lancet into it, with no other Deſign than to take it up, and place it in the Microſcope to ſee what it might be; which I had no ſooner done, than, to my great Surprize and Joy, I found the Lancet had fortunately opened a membranous Caſe, that included a *perfect Plant*, ariſing from a double Root in the Baſis of its ſaid Caſe, with Two Stems of an equal Height, each whereof had many Leaves upon it, like the Graſs from whence it was produced. This was a Sight I little expected to meet with; and being aware how much Imagination has frequently had to do with microſcopial Obſervations, I diſtruſted my own Eyes, and examined it every way I could contrive, to prevent being deceived; but in all Poſitions I found it a Reality. Wherefore having ſecured it between Two Pieces of *Iſinglaſs*, together with the Caſes that incloſed it, (as in the Hole of the ſame Slider, Fig. 2. (*ſee* TAB. II. Fig. 3.) I afterwards cut open a great many Seeds of the ſame ſort, in hopes I might be able to ſeparate one of theſe *minute Plants* intirely from its *Theca*; which at laſt I ſucceſsfully effected, and placed as in the Hole (*ſee* TAB. II. Fig. 3, 4).

Having never met with any Experiment, that ſo plainly proved the Exiſtence of a real and perfect Plant *in Semine*, I imagined an Account thereof might be acceptable to this moſt learned SOCIETY, which encourages every Endeavour for the Advancement of true Knowledge: And I beg Leave, with all Submiſſion, to recommend to your Conſideration, how far this Diſcovery may conduce towards aſcertaining the Manner of Generation.

A Dozen Lines, in a little Poem called *The Univerſe*, are ſo adapted to the preſent Subject, that, if a Quotation from myſelf may be excuſed, I ſhall conclude with them.

*Each*

*Each Seed includes a Plant: that Plant, again,*
*Has other Seeds, which other Plants contain:*
*Thoſe other Plants have All their Seeds, and Thoſe*
*More Plants again, ſucceſſively, incloſe.*
*Thus, ev'ry ſingle Berry that we find,*
*Has, really, in itſelf whole Foreſts of its Kind,*
*Empire and Wealth one* Acorn *may diſpenſe,*
*By Fleets to ſail a thouſand Ages hence.*
*Each* Myrtle *Seed includes a thouſand Groves,*
*Where future Bards may warble forth their Loves.*
*Thus* Adam's *Loins contain'd his large Poſterity,*
*All People that have been, and All that e'er ſhall be.*

Henry Baker.

An Explanation of the Figures. *See* TAB. II.

Figure 1.

*The* Beetle, *mentioned in the preceding Paper.*

Figure 2.

*A Seed of the* Gramen tremulum *intire, of the natural Size.*

Figure 2 *.

*The ſame magnified.*

Figure 3.

*A Seed of the* Gramen tremulum *diſſected,* viz.

A. *One Lobe or Side of the Seed.*

B. *A membranous Caſe containing a minute Plant, which ariſes with Two Stems bearing many Leaves*

*Leaves from its* Radicle *in the Baſis of th ſaid Caſe: This Caſe lies between the Tw Lobes, and, before it is opened, ſeems to be th* Germen *of the Seed.*

C. *A Piece of the Caſe cut off in opening.*

Figure 4.

A. *A Lobe of the Seed.*

B. *The minute Plant extracted from its Caſe, tha its Root and Branches may be ſeen to bette Advantage.*

C. *The Caſe whence the minute Plant was taken.*

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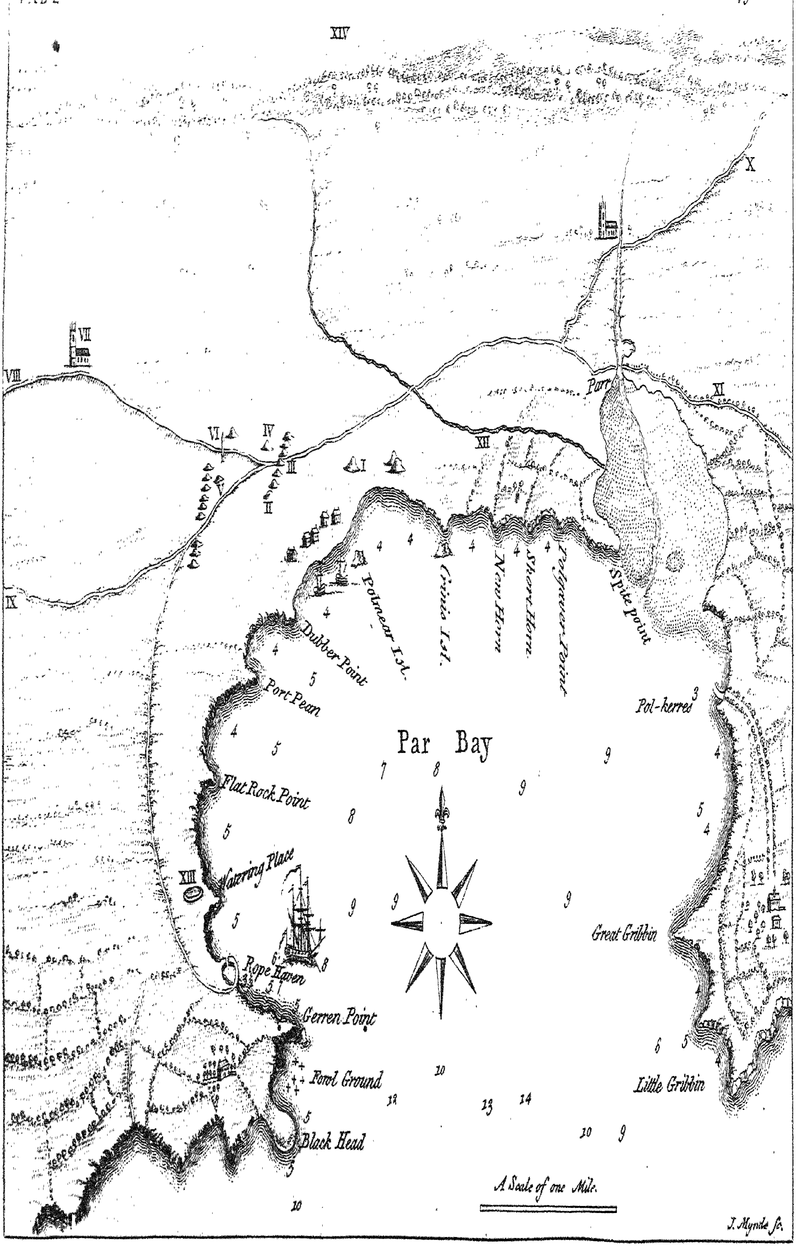
TAB. I.

Philos. Trans. No. 458.



J. Mynde sc.

Barrow N° III.

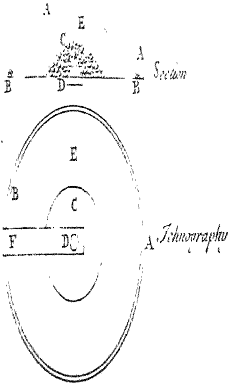


Fig. 1.

Plan of Castle Gotha

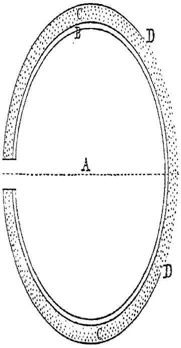


Fig. 4.

Barrow N° IV.

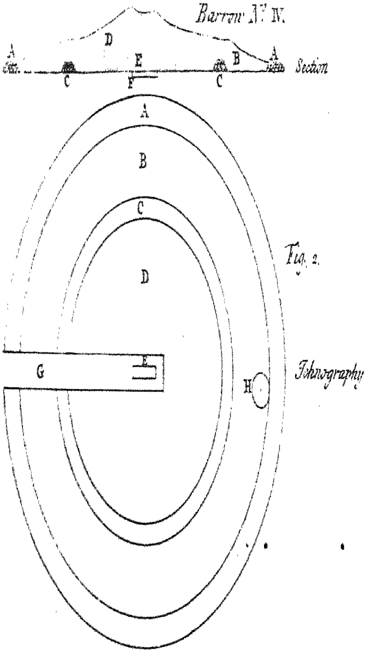


Fig. 2.

The Urn

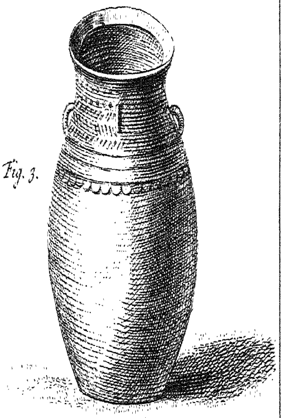


Fig. 3.

A Scale of feet for Barrow N° III & IV.

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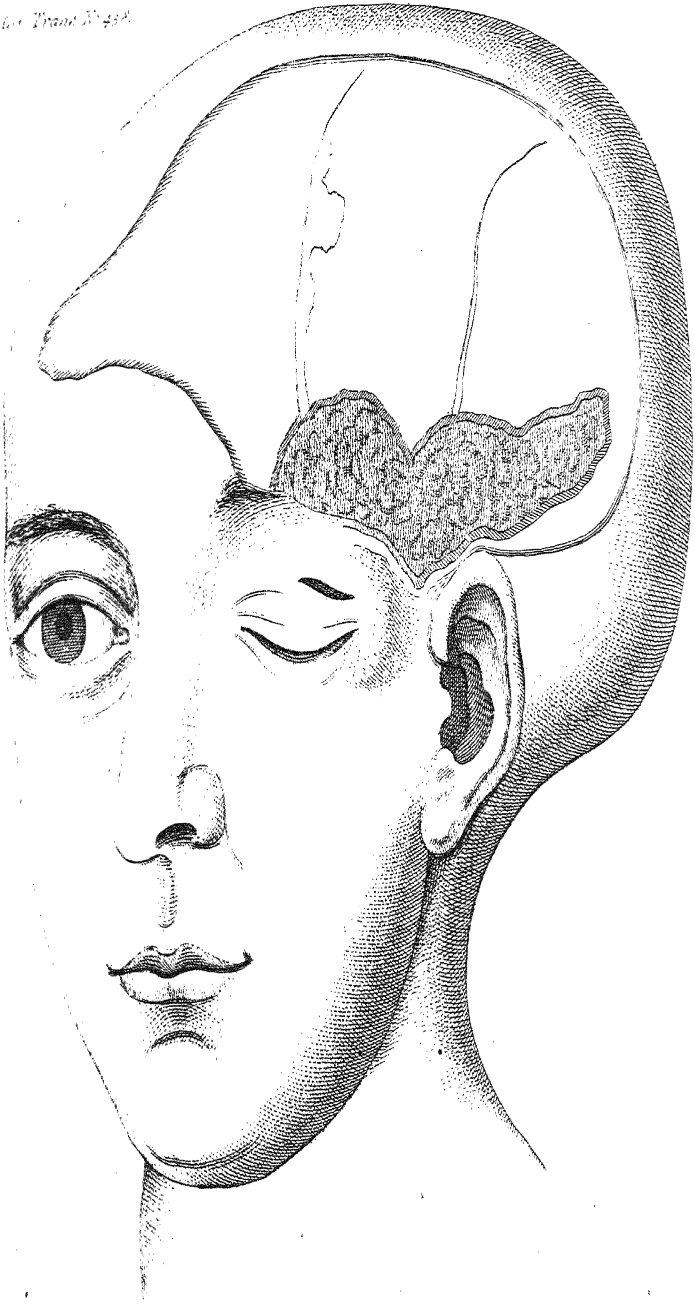
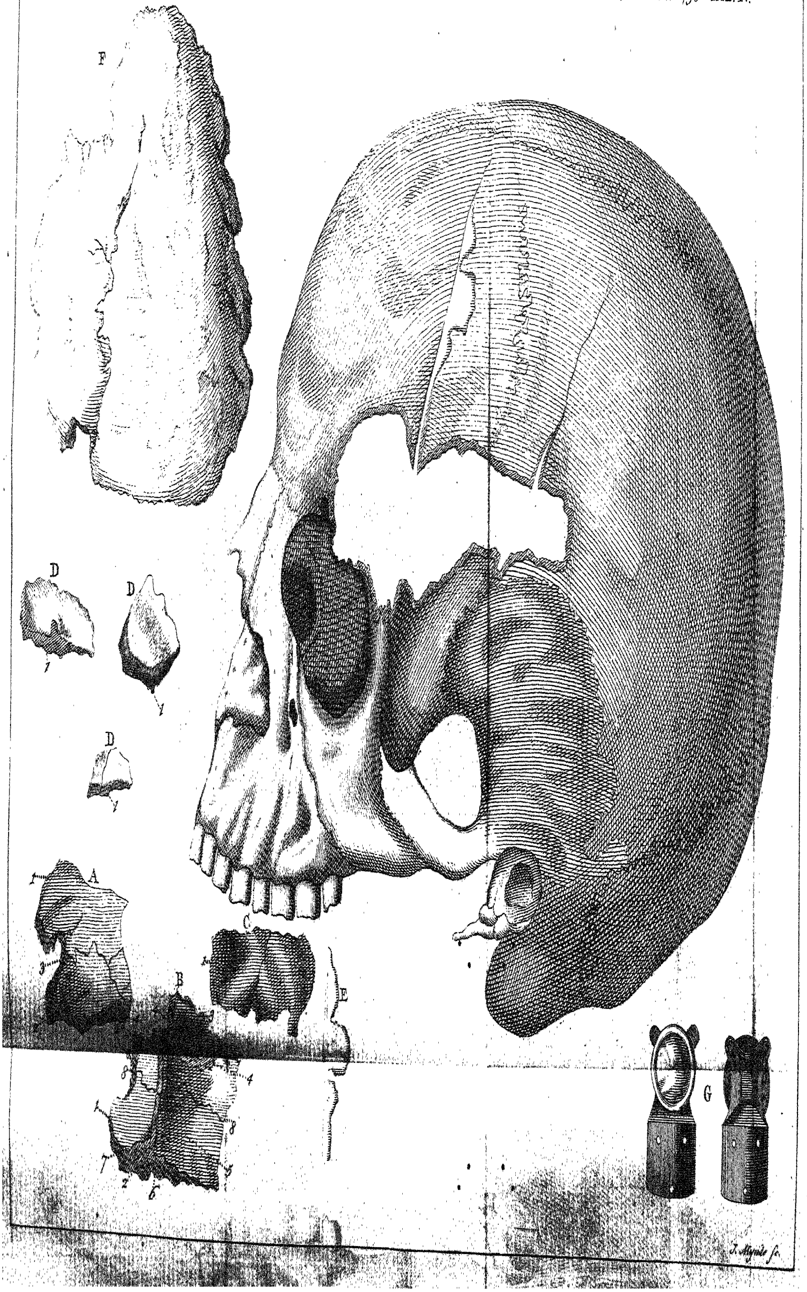
Philos. Trans. N° 458



Philos. Trans. Nº 458. TAB. IV.



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Numb. 458.

# PHILOSOPHICAL TRANSACTIONS.

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For the Months of *September*, *October*, *November*, and *December*, 1740.

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# I. *An Account of the* Analogy *betwixt* Engliſh Weights *and* Meaſures *of* Capacity, *by the Rev^d Mr.* William Barlow *of* Plymouth.

THE Analogy betwixt antient *Engliſh* Weights and Meaſures ſeems for many Ages to have been intirely forgotten and unknown.

Our Forefathers ſuppoſed a cubic Foot of Water (aſſumed as a general Standard for Liquids) to weigh 62 Pound ½; the Exactneſs of which Suppoſition is confirmed by modern Obſervation: For in *Philoſophical Tranſactions*, N° 169. we find the Weight of a Foot of Pump-water to be 62 Pound 8 Ounces. From a cubic Foot of Water multiplied by 32, is raiſed a Ton Weight, or 2000 Pound, luckily falling into large round Numbers, and for that Reaſon made Choice of.

Agreeably hereto were liquid Meaſures accommodated, *viz.* 8 cubic Foot of Water made a Hogſhead, and 4 Hogſheads a Ton in Capacity and Denomination as well as Weight.

Dry Meaſures were raiſed on the ſame Model. A Buſhel of Wheat (aſſumed as a general Standard for all ſorts of Grain) was ſuppoſed to weigh 62 Pound ½, equal to a Foot of Water; 8 of theſe Buſhels a Quarter, and 4 Quarters a Ton Weight.

Coals were ſold by the Chaldron, which was ſuppoſed to weigh a Ton or 2000 Pound. See *Chambers's* Dictionary.

Therefore, though the Meaſures containing a liquid Ton, 4 Quarters of Wheat, a Chaldron of Coals,

*&c.* be all of different Capacities; yet the reſpective Contents are every one of the ſame Weight: A Ton in Weight is the common Standard of all.

In After-times, through Ignorance of this Analogy, a Variety of Weights and Meaſures were introduced, incommenſurate, and not reducible to any common Standard, or analogous Relation: Whereas, had the original Analogy been kept up, it would have prevented that Diſorder and Confuſion ſo juſtly complained of at preſent concerning the Subject of Weights and Meaſures.

From the foregoing Scheme it is reaſonable to ſuppoſe, that Corn, and ſeveral other Commodities, both dry and liquid, were firſt ſold by Weight; and that Meaſures, for Convenience, were afterwards introduced, bearing ſome Analogy to the Weights before made uſe of.

From the modern Experiment before-mentioned, (a cubic Foot of Water weighing 62 Pound 8 Ounces) it appears, that the Meaſure of a Foot, and the Weight of a Pound, are the ſame now as were in Uſe many Ages before the Conqueſt.

The foregoing Scheme aſſigns a Reaſon, why the word *Ton* is applied both to Weight and liquid Meaſure; *viz.* becauſe the ſame Quantity of Liquor is a Ton both in Weight and Meaſure. Probably 4 Quarters of Grain had formerly the ſame Appellation, till the Significancy of it was loſt in the Uſe of the *Avoirdupois* Ton.

The Word *Quarter*, as applied to Grain, is alſo hereby explained. Moſt Writers have ſuppoſed it the 4th Part of ſome Meaſure, but what that Meaſure was could never ſatisfactorily be made out. The learned *Fleetwood* gueſſed neareſt the Truth, ſuppoſing it the 4th Part——not of any Meaſure, but——of ſome Load or Weight [*Chron. Pretioſ.* p. 72.]. I wonder he ſtopped here, and did not obſerve what that Load of Weight was, *viz.* a Tun or 2000 Pound: But the *Avoirdupois* Ton, in Uſe at preſent for all groſs Weights, threw ſuch a Miſt upon the Subject as could not eaſily be ſeen through.

From the original and natural Signification of the word *Hundred*, it plainly appears, that *Twenty hundred*, or a *Ton*, muſt be exactly Two thouſand Weight.

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## II. *An Account of a Tract intituled*, Jo. Friderici Weidleri Commentatio de Parheliis Menſe Januario Anni 1736. prope Petroburgum Angliæ & Vitembergæ Saxonum viſis. Accedit de rubore cœli igneo Menſe Decembri Anni 1737. obſervato Corollarium. Vitembergæ, 1738. 4°. *Drawn up by* Tho. Stack, *M. D.* F. R. S.

THIS Tract is divided into 17 Sections. In the *1ſt* and *2d* the Author deſcribes his own Obſervation of Two Mock-Suns at *Wittemberg*, on *Jan.* 11. 1735-6, *N. S.* In the 3*d* he gives a Meteorological Diary from *Jan.* 1. to 18. and in the 4*th* the Rev$^{d}$ Mr. *Neve*'s Obſervation on $\frac{Dec.\ 31.}{Jan.\ 11.}$ of Two *Parhelia* near *Peterborough*. But theſe Deſcriptions have been already communicated to the ROYAL SO-

CIETY *. In the *5th* he compares the Two Obſervations. In the *6th* and 7th, he mentions ſeveral *Parhelii* taken notice of by the Antients and Moderns; and in the *8th* enumerates the different Obſervables of this *Phænomenon*, for the better inveſtigating its Cauſes.

The *9th* gives the Opinions of ſeveral of the Antients concerning the Preſages taken from Mock-Suns.

From the *10th* to the *13th* incluſive, he relates divers Manners of accounting for them, by the chief of the Antients and Moderns.

In the *14th*, preparatory to his own Opinion, he lays down the Doctrine of the Riſe of Vapours in ſmall globular Bubbles of Air, with a watery Coat to each.

In the *15th*, he refutes, by ſeveral Reaſons and Experiments, *Huygens*'s Manner of accounting for *Haloes*, which is by a vaſt Number of very ſmall Vapours, each with a ſnowy *Nucleus*, coated round with a tranſparent Covering: And ſays, that when the Sun depicts its Image in the Atmoſphere, and by the Force of its Rays puts the Vapours in Motion, and drives them towards the Surface, till they are collected in ſuch a Quantity, and at ſuch a Diſtance from the Sun on each Side, that its Rays are twice refracted, and twice reflected, by the time they reach the Eye; they exhibit the Appearance of a *Halo*, adorned with the Colours of the Rainbow: Which may happen in globular pellucid Vapours without ſnowy *Nuclei*, as appears by the Experiment of hollow glaſs Spheres filled with Water. Therefore, whenever thoſe ſpherical Vapours are ſituated, as before,

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* *Philoſophical Tranſactions*, N° 445.

fore, the Refractions and Reflexions will happen every-where alike, and the Figure of a circular Crown, with the uſual Order of Colours, will be the Conſequence.

As to the *Halo*, that attends *Parhelia*, being 44 or 45 Degrees in Diameter, he adopts *Gaſſendi*'s Opinion as probable, who applies to it the Geometrical Theorem: *De Angulo ad Centrum, duplo Anguli ad Peripheriam.* For when a *Halo* ſurrounds the Sun, the Sun is in the Centre, and the Eye out of it, as it were on the Surface of the *Phænomenon*; whereas, when the Rainbow appears, the Eye is placed in a Line drawn from the Sun to the Centre of the Rainbow: And thus the Eye ſerves for a Centre, from which the Diameter of the *Iris* is beheld, the Sun being placed on the Circumference. Yet he ſays, it ſtill remains to be accounted for, Why, when Two *Haloes* appear at once, the Greater is double the Diameter of the Leſs, *i. e.* about 90 Degrees?

16*th*, But as *Haloes* often appear about the Sun and Moon, without *Parhelia* or *Paraſelinæ*, there muſt be a peculiar Diſpoſition of Vapours requiſite for forming *Parhelii*.

*Parhelii*, he ſays, are ſituate either in the Interſection of a vertical *Halo*, and the horizontal *Annulus*, which paſſes through the Sun; or in the Section of ſome horizontal Bands and the *Corona*: And the angular Figure of *Parhelia* leaves us no room to doubt, that it is produced by Planes of the *Annulus* or Bands running into the *Corona*. Now *Newton*'s Theory of Colours, and the Experiments it is built upon, ſhew, that Whiteneſs, which is a heterogeneous Light, is reſtored by blending or collecting the coloured Lights: And this will likewiſe happen, when the white heterogeneous Light of the bright Ring or Band does penetrate and confound the Rays of the *Halo*, now ſomewhat weakened. It is plain, that in order to a genuine Explication of Mock-Suns, it is chiefly requiſite to have a clear Notion of the Origin of the horizontal Ring, or Bands. And from *Huygens*'s Experiment with a cylindric Glaſs full of Water expoſed to the Sun, which produces a white horizontal Ring by Reflexion alone, without an opake *Nucleus*; he aſſerts that the horizontal Bands, that interſect the ſolar *Coronæ*, are formed, when cylindric frozen Vapours are ſuſpended about the Sun, chiefly where the *Halo* is depicted, in a Situation perpendicular to the Horizon; which being rectilinear, each of them exhibits by Reflexion a lucid Line equal to the Sun's Diameter; and ſeveral of theſe optic Lines joining, compoſe the Plane of the Ring or Band.

His laſt Section is ſpent in explaining the Appearance of Part of an inverted *Iris*, which accompanied his Mock-Suns: In order to which, he thus accounts for a (common or) primary Rainbow.

A primary *Iris* is formed, when the Sun's Rays falling on Drops of Rain, after ſuffering Two Refractions, and One Reflexion, tend to the Eye in ſuch a Direction, that the Axis of the *Iris*, coming directly from its Centre, and paſſing by the Eye to the Sun, makes with theſe Rays returning from the Drops, an Angle of 40 Degrees below, and of 42 Degrees above; whereby the Width of the *Iris* is 2° 15′, and its Diameter 42° 17′.

But as this inverted *Iris* was but One Degree broad, and the Diameter of the Arch probably but half that

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of the primary *Iris*; he is of Opinion, that the Sun's Rays, refracted and reflected as above, entered the Eye at half the aforeſaid Angle, by the Eye's being placed beyond the Point, where the Rays met with the Axis. For thus the Order of the Colours is preſerved, and this *Iris* is but half the Size of the common one.

As an Appendix to this Tract, Profeſſor *Weidler* adds the following Account of the remarkable red Lights on the $\frac{16}{5}$ *December* 1737. ſeen not only by him at *Wittemberg*, but here at *London*, and in moſt Parts of *Europe*.

*December* 9. 1737. the Barometer was remarkably low; *viz.* 28 Inches 8 Lines *English* Meaſure. It rained all that Day very plentifully; and from thence to the End of the Month the Sky was much loaded with thick Vapours. But on the 16th, the little Wind there was being at North-weſt, and the Barometer at 30 Inches 2 Lines $\frac{3}{4}$ *London* Meaſure, ſoon after Sun-ſet, (the Moon in its laſt Quarter) the Sky began to appear very red; and, from Seven to Nine, gave a Light as ſtrong as that of the Full Moon behind a thin Cloud. The whole Sky was of that Colour, which is occaſioned by a Fire ſeen at a Diſtance in the Night. Such an uncommon Sight put the Inhabitants of this Town in great Terror. The greateſt Brightneſs here was about 8 h. $45'$; from which Time it gradually decreaſed; and at a Quarter after Nine it ſeemed almoſt diſſipated. But it returned now-and-then, and continued, by Intervals, all Night. Now though the whole Face of the Heavens was remarkably red, yet the greateſt Brightneſs was in the North, and a little to the Weſt. There were neither Pyramids, nor luminous Streamings, ſo common in *Auroræ Boreales*; nor even the leaſt Appearance of the horizontal black Cloud at North. The following Day was equally dark with the preceding, yet without the leaſt Remains of the Redneſs. Such was the Face of the Heavens at *Wittemberg*, and in the Neighbourhood. And, ſoon after, the public News gave an Account of the like *Phænomenon* being ſeen at *Vienna*, *Venice*, *Mantua*, *Florence*, *Rome*, and ſome other Places. At *Vienna* the greateſt Brightneſs was obſerved at 9 h. 15′. The moſt enlightened Parts were the North-weſt and South-ſouth-eaſt; and there were ſome Returns of the Brightneſs on the 17th and 18th. But in *Italy*, at *Mantua*, *Florence*, and *Rome*, the Redneſs was accompanied with lucid Columns and Pyramids. And from *Rome*, in particular, they write, that this *Aurora Borealis* exceeded in Brightneſs all thoſe that had been hitherto obſerved. From theſe Obſervations it is no difficult Matter to deduce the Cauſes of theſe red Lights.

That this *Aurora Borealis*, on the 16th, was a very conſiderable one, appears both by the great Expanſion of the luminous Matter from its Riſe in the North towards the South, and by the Return of the Brightneſs ſeen at *Vienna* on the ſubſequent Days. At *Mantua* the Northern Light reached the *Zenith*, and it is more than probable it did ſo in our more Northern Horizon: Wherefore, as the Matter was collected at the *Zenith*, the Light was reflected thence to all Parts of the Sky. But as the lower Region of our Atmoſphere was at the ſame time overſpread with Vapours of a certain uniform Denſity, and intirely proper for ſeparating an homogeneous Light; thoſe Rays of the heterogeneous Light, which are the leaſt refrangible, or which produce the red Colour, were accordingly ſeparated by Reflexion and Refraction in great Quantities, and coloured the whole Sky with a firy Redneſs. And where the Light was brighteſt, *viz.* between the North and Weſt, which is generally the Focus of *Auroræ Boreales*, there likewiſe the Redneſs was ſtrongeſt.

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## III. *An Attempt to examine the* Barrows *in* Cornwall, *by* Stephen Williams, *M. D.* F. R. S.

IT may not be improper to obſerve, that theſe *Barrows*, or conical Hillocks, are generally ſituated on Places of Eminence, on or near the Summit of Downs, and ſo capable of being ſeen at a great Diſtance; and likewiſe very often near the moſt public or greateſt Roads, though ſometimes in incloſed or fenced Lands, but not often: They lie ſometimes Two, Three, even Seven, in a ſtrait Line, now-and-then only One or Two by themſelves: Sometimes alſo the ſingle ones ſeem to regard, in reſpect of their Poſition, a greater Number, as is obſervable in Tab. I. No IV. where the Urn was found, and No V. on the ſame Down.

The Height and Dimenſions of the *Barrows* in *Cornwall*, are various, from Four to Thirty Feet high, and from Fifteen to One hundred and Thirty broad;

but they always bear a regular Proportion in their Form. Some have a *Foſsa* or Ditch round their Circumferences, others none; ſome a ſmall Circle of Stones at the Top, others none; ſome a Circle of Stones round the extreme Verge of their Baſis.

The *Barrows*, which are the Subject of our preſent Inquiry, lie on the Summit of *St. Auſtle Downs*, about a Mile from the Town, and half a Mile from the Sea; where a fine Bay is formed by Nature, well defended from moſt Winds, with good Anchorage, and deep Water. Mr. *Mitchel*, Lieutenant in the Navy, has lately taken a curious Survey of it, by Order of the Admiralty, and for the Benefit of the *Engliſh* Fleet. *See* TAB. I.

### BARROW, N° 1.

We opened *Barrow*, N° 1. a ſmall one, with no Ditch round it, but a ſmall Circle of Stones on the Top, of the Height of Four Feet, of the Breadth, at the Baſis, of Fifteen: When we had taken off the Surface, the Body of the *Barrow* ſeemed to be compoſed of foreign or adventitious Earth, which being cut through near the Centre, we found a circular Pit of a Foot deep, and of the ſame Diameter, dug out of the natural Soil of the Country, and Two flat Stones in it. By adventitious or foreign Earth, is meant ſuch as does not riſe on the Place, but is fetched from ſome Diſtance; ſo the Earth of this and the other *Barrows*, of a yellow Colour, is known to be the natural Soil of a Hill a Mile diſtant from them.

### BARROW, N° II.

The perpendicular Height is about Eight Feet, Diameter, at the Baſe, about Thirty Feet, with a *Foſſa* or Ditch round it: The Surface being removed, the Body of the *Barrow* conſiſted of the adventitious Earth, of a yellow Colour, and now-and-then ſome ſmall Stones interſperſed, not regularly; at the Middle we found a Pit of a cylindrical Shape, Two Feet broad, and One Foot and half deep, out of the natural Soil: Over the Pit we obſerved Three Stones placed edgeways, to cover the ſame, though nothing in it but ſome Earth of the *Barrow*, and Three ſmall Stones.

### BARROW, N° III.

The perpendicular Height of the *Barrow* was Ten Feet and half, Diameter at the Baſe Forty-ſix, with a Ditch round it: Upon removing the Heath or Graſs, (which was the common Surface to all the *Barrows*, we obſerved the ſame yellow adventitious Earth, which being penetrated a Foot through, we found a ſmall Circle of Stones at *B*, which ſurrounded the *Barrow* [TAB. II. Fig. 1.]; then being paſſed through the ſame yellow Earth, we came to *C*, within Ten Feet of the Centre of the *Barrow*, where we found a *Stratum* or Lay of flat Stones, carefully laid flatways, to cover the reſt underneath, as in the Roof of an Oven; which being taken off by the Six Tinners, (whom an ingenious Gentleman of *St. Auſtle*, and myſelf, employed on Purpoſe) a large Bed or Heap of Stones, irregularly and confuſedly mixed together, and of various Sorts, appeared, and under them a large Number of Stones artfully placed and contrived, ſo as to form the Shape of a Cone, their Points uppermoſt, and their largeſt Parts downward. Under this Heap we ſaw a Circle of Two Feet Diameter, equal in Height with the natural Surface of the Country, and cauſwayed with ſmall Stones laid edgeways, their ſharpeſt Point downward; which Stones being taken up, we obſerved a cylindrical Pit at *D*, Two Feet broad, and Two Feet and half deep, cut out of the natural Soil, as the former; the Sides of the Pit were carefully lined round with theſe flat Stones, though none at the Bottom. We met with, firſt, ſome ſmall Stones of various Shapes and Sizes, lying irregularly; under them appeared a black greaſy Matter, but not above an Inch thick; ſome of the adventitious Earth had crept through the Crevices of the cauſwayed Stones into the Pit. It deſerves our ſerious Obſervation, that the Stones (which compoſed the Heap lying over the cylindrical Pit) were brought from Places both high and low ſituated, and many Miles diſtant from one another, as the *Par*, *Polmeor-Clif*, *Hainsbarrow*, *Pentuan*, and *Carnclays*, a high Hill, the Diſtance between ſome of theſe being Four or Five Miles.

### BARROW, N° IV.

Though we had hitherto found no Urn, yet being perſuaded by the unctuous black Earth, and the cylindrical Pits, in the Centre of every one of the *Barrows*, the artful Poſition of the Stones to cover and guard them, and the foreign Earth, that theſe *Barrows* were erected for Sepulchres; we reſolved to proceed farther, and pitched upon N° IV. as one ſomewhat different from the reſt, both as its Situation ſeemed to regard a greater Number of *Barrows*, and as its Circumference appeared to have a very large Circle of Stones round it, without any Ditch or *Foſſa*.

We began our Paſſage at *A* [TAB. II. Fig. 2.] through a Circle of Stones of Five Feet broad, and Two high; then we paſſed through adventitious Earth *B*, when we came to a Second Circle at *C*, of Stones of Three Feet high, and Three Feet broad; after them appeared nothing but foreign Earth, till we found, at the Centre *E* of the *Barrow*, an oblong ſquare Pit, of the Depth of One Foot and half, and Breadth Two Feet, and Length Five Feet; in the Bottom appeared a black greaſy Matter or Subſtance, as in the laſt *Barrow*, about an Inch thick; the Pit was not covered or defended by any Stones. However, being not ſatisfied, we examined the uttermoſt Circle of Stones, and on the Inſide of it we ſtruck on a great flat Stone, about Five Feet broad, and One Foot thick, under which, when lifted up, we found Two other thin flat Stones, and under them a ſmaller flat Stone, which covered an Urn, [TAB. II. Fig. 3.] which alſo ſtood upon another flat Stone in a ſmall Pit, deeper than the Circle of Stones, and carefully wedged in, as well as ſupported, with many ſmall Stones round it: This Urn is made of burnt or calcined Earth, very hard, and very black in the Inſide; it has Four little Ears or Handles; its Sides are not half an Inch thick; in it were Seven Quarts of burnt Bones and Aſhes; we could eaſily diſtinguiſh the Bones, but ſo altered by the Fire as not to be known what Part of the Skeleton they compoſed: The Urn will hold Two Gallons and more; its Height is Thirteen Inches and half, Diameter at the Mouth

Eight, at the Middle Eleven, and at the Bottom Six and half.

Before we proceed any farther, a natural Obſervation will occur, in what Manner the Antients (that uſed Cremation, and all Nations of that way of Burial) expreſſed their Regard for the Deceaſed; and this plainly appears from the Structure of the *Barrows* or *Tumuli*, particularly N° III. which is not only compoſed of foreign Earth, but of Stones brought from ſo many and ſo different Places; for, in erecting theſe *Tumuli*, the greater the Charge or Trouble, the greater muſt be the Reſpect due to their Princes or Generals. Thus each Soldier or Friend might bring ſome of the Earth or Stones from diſtant Places, where they lived, or were ſtationed, to compoſe the *Tumulus*, which generally was in proportion to the Greatneſs, Rank, or Power of the Deceaſed. Many Paſſages might be repeated from Authors of different Nations; but a few will not be tedious: Thus *Horace*, [*Lib.* I. *Ode* 28. *Carm.*]

*Quanquam feſtinas, non eſt mora longa; licebit*
*Injecto ter pulvere curras.*

Thus, again, we find *Achilles*, in *Homer*, complaining, how ſmall a *Tumulus* he had made for his beloved *Patroclus*, [*Iliad.* Ψ. v. 245.]

*Τύμβον δ' οὐ μάλα πολλὸν ἐγὼ πονέεσθαι ἄνωγα,*
*Ἀλλ' ἐπιεικέα τοῖον*, &c.

That theſe *Tumuli* were erected by pouring on Earth, or heaping up Stones, is plain from the Words ſo frequent in *Homer*, [*Homer*, *Iliad.* Ψ. v. 257.] χέαν, χεύαντες τόδε σῆμα; and χερσὶν ἐχωννύμεθα, in the

*Anthol. Epigr.* Again, that they were compoſed of Stones, appears from the Words, *Λαΐνοισι τ᾽ ἐξογκώμασι* in *Euripides*, and ſometimes poliſhed, *ξεστοὶ τάφοι*, *τύμβος ξεστός*, from the ſame Author. Parallel to this, Mr. *Rowland*'s Obſervation appears, who found a curious Urn in a *Carnedd*, or Heap of Stones, in *Angleſey* [*Mona Reſt. pag.* 49.]. So the *Britains* had the ſame Cuſtom of throwing Stones on the Deceaſed: Hence comes the *Welſh* Proverb, *Karn ar dy Ben*, I'll betide Thee.

So, again, Pillars of Stones were erected as Sepulchral Monuments, near the Ways, or in Memory of ſome Battle or Victory, as well as for Places of Religion and Sacrifices. I need not quote the Eaſtern Authors ſo well known; only obſerve, that they are frequent in *Cornwall* and *Wales*, were called *Meini Gwyr*, a Stone for Play, perhaps in Memory of Funeral Games, and ſometimes *Llech*, i. e. *Tabula Saxea*: The following is a remarkable one.

## *A* STONE PILLAR.

This large Stone is called by the Natives *Long Stone*, [TAB. I. No VI.] and ſtands upright on the Summit of the Downs, between the Highways after they are divided: The End fixed in the Earth has been examined above Eight Foot deep, but not diſcovered how much lower it lies; above the Surface of the Earth the Stone meaſures Thirteen Feet in Height, Three Feet in Breadth, and Two Feet and half in Thickneſs.

### *An* ENCAMPMENT.

An Encampment, about a Mile and half diſtant, ſhews itſelf [TAB. I. Nº XIII.]: It lies near the Cliffs, and overlooks *Par*, or *St. Auſtle-Bay*, by its high Situation: The Form is a true Circle, about an hundred Yards Diameter; the *Agger*, or Rampart, is very low; the Ditch is about Two Yards deep, and Five broad, imperfect towards the Sea, where the Ground has a great Declivity, and the Aſcent to the *Agger* more difficult: It is called *Caſtle Gotha* [TAB. II. Fig. 4.]. However, to prevent the Influence which a falſe Interpretation might produce, we muſt obſerve, that *Gothys*, both in *Welſh* and *Corniſh*, ſignifies High, or Proud; ſo that from *Kaſtelh*, or *Caſtellyn Gothys*, eaſily flows *Caſtle Gotha*, in the modern Dialect, as its Situation declares.

I have annexed a Map of *Par Bay*, [TAB. I.] (as copied from Mr. *Mitchel*, by a good Hand of our Dock) and of the Country, with the *Barrows*, Stone Pillar, *&c.* that this Eſſay may be rendered more intelligible. I have alſo been more nice in examining the internal Structure of theſe *Barrows*, as will appear by the Section and Ichnography of them. Becauſe the beſt Authors have been contented with an external View of theſe *Tumuli*, but never penetrated the inmoſt Receſſes, nor have we left any certain Characteriſtic to diſtinguiſh one Nation from another, I wiſh my Endeavours may give any new Light into this Affair.

It will be tedious and needleſs to enumerate what Nations burnt their Dead, and erected *Tumuli* over them; we muſt only remember, that it was the Cuſtom among moſt Eaſtern Nations, and continued with them, after their Deſcendents had peopled the moſt Weſtern and Northern Parts of *Europe*: Hence it is eaſily traced in *Greece*, *Latium*, *Iberia*, *Gallia*, and *Britannia*, as well as *Germany*, *Sweden*, *Norway*, *Denmark*, till *Chriſtianity* appeared, and aboliſhed it.

Let us next conſider what Nation or People inhabited, or were acquainted with, the moſt Weſtern Part of *Britain*.

## CELTÆ.

That the *Celtæ* and *Britains* inhabited here, need not be proved; though, perhaps, I may hereafter trace their Relics or Remains of *Druidiſm* in *Carneds*, *Cromleches*, *Meini Gwyrs*, Fortifications, and the like.

## PHOENICIANS *and* GRECIANS.

That the *Phœnicians* firſt, and after them the *Grecians*, knew theſe Iſlands, and traded here for Tin, long before the *Romans* Knowledge of them, is plain, and eaſily proved by *Grecian* and *Roman* Authors, as *Strabo*, *Polybius*, *Pliny*, &c. *Polybius* wrote a Book, Περὶ τῶν Βρεττανικῶν Νήσων, ϗ τȣ̃ Κασσιτέρȣ Κατασκευῆς. Which Book, though now loſt, yet *Strabo* witneſſeth, that therein he refuted the Errors of *Dicæarchus*, *Pythias*, and *Eratoſthenes*, concerning the Magnitude of *Britain*, Authors much older than himſelf. And though Diſputes may ariſe, whether the *Bratanac* of the *Phœnicians* gave Name to theſe Iſlands, yet it is certain, that the *Greeks* knew them under the Title of *Caſſiterides*, the Tin-Iſlands.

But whether theſe Nations were ever ſettled here as Inhabitants, and became Bodies Politic, to erect

Fortifications, Towns, Cities, Encampments, and the like, is without any Certainty. Indeed a learned, and no leſs laborious Author, [*Sammes's Britan.*] has endeavoured to derive the Names of Places, Cuſtoms, Religion, Art of War, Language and Government of the antient *Britains* from the *Phœnicians* being ſettled here; and this only upon a ſuppoſed Affinity between ſome *Britiſh* and *Phœnician* Words, and their Trade for Tin: But by the ſame way of Reaſoning, we might as well and eaſily prove, that the *Phœnicians* received theſe very Words from the Deſcendents of *Gomer*, the *Celtæ*, before they paſſed over the *Helleſpont*; and alſo that the *Britiſh* or *Celtic* Words, which occur in the *Grecian* and *Roman* Languages, are derived and owe their Origin to the ſame People as they journeyed Weſtwards, and ſent Colonies to different Parts to inhabit them, particularly the moſt South; the Northern Parts being peopled by the Deſcendents of *Askenez*, *Gomer's* Son: Hence the *Teutonic* Language flows, though not without ſome Affinity to the *Celtic* in few Words.

## ROMANS.

That the *Romans* conquered great Part of *Britain*, is not diſputed; but whether they poſſeſſed the moſt Weſtern Part, now *Cornwall*, many Learned doubt. Let us enumerate the chief Arguments and Proofs for it: The Geography and Figure of *Britain* is delivered in various *Grecian* and *Roman* Authors, and the moſt Weſtern Part is not forgot. *Cæſar*, the firſt *Roman* Invader, mentions the triangular Form of the Iſland, [*Comment. Lib.* V.] *Inſula eſt triquetra*;

*quetra; unum latus eſt contra Galliam, alterum vergit ad Hiſpaniam & ſolem occidentem, qua ex parte eſt Hibernia; tertium eſt contra ſeptentrionem.* But, out of a great many, let us hear *Ptolemy* Geograp. Lib. II.

Νήσου Βρεττανικῆς θέσις.—Δυσμικῆς πλευρᾶς περιγραφή, ἣ παράκειται, ὅτε Ἰβέρνικὸς ὠκεανὸς, καὶ ὁ Οὐεργιούιος.—Ἡρακλέους ἄκρον, Ἀντιουέσταιον ἄκρον, τὸ καὶ Βολέριον· Δαμνόνιον, τὸ καὶ Ὄκρινον ἄκρον· τῆς ἐφεξῆς μεσημβρινῆς πλευρᾶς περιγραφή, ἣ ὑπόκειται Βρεττανικὸς ὠκεανὸς, μετὰ τὸ Ὄκρινον ἄκρον· Κενίωνος ποταμοῦ ἐκβολαί, Ταμάρου ποταμοῦ ἐκβολαί, Ἰσάκα ποταμοῦ ἐκβολαί. And again: Μεθ' οὓς [Δουροτρίγας,] δυσμικώτατοι Δαμνόνιοι, ἐν οἷς πόλεις Οὐολίβα, Οὔξελλα, Ταμάρη, Ἴσκα. Λεγεὼν δευτέρα Σεβαστή.

Which may be thus tranſlated: “After the Poſition of the *Britiſh* Iſland, let us ſurvey the Weſtern Side, which lies along the *Iriſh* and *Vergivian* Seas, where lie the Promontory of *Hercules*, the Promontory *Antiveſtæum*, ſometimes *Bolerium*, the Promontory *Damnonium*, called alſo *Ocrinum*; and in the Side towards the South, and bounded by the *Britiſh* Ocean, after the Promontory *Ocrinum*, the Rivers *Cenion*, *Tamar*, and *Iſaca*, diſcover themſelves, by diſcharging themſelves into the Sea.” The Coaſt and Rivers being mentioned, next deſcribed are the Cities. “The moſt Weſtward after the *Durotriges*, are the *Damnonii*, among whom are theſe Cities (πόλεις); *Voliba*, *Uxela*, *Tamare* and *Iſca*, with the *Legio Secunda Auguſta*.” *Ptolemy* of *Alexandria*, under the Reigns of *Trajan*, *Hadrian*, and *Antoninus Pius*, wrote his Geography. In the *Iter Britan. Antonini, Itiner.* XII & XV. ſuppoſed to be compoſed or begun in the Times of *Antoninus Pius* or *Caracalla*, Mention is made of *Dumovaria*, *Moriduno*, * *Scadum Nunniorum*, *Leucaro*, *Bomio*, and *Nido*, *Iter* XII. and in *Iter* XV. of *Dumovaria*, *Moriduno*, *Iſca Dumnoniorum*. That by theſe laſt-mentioned Names are meant *Dorcheſter*, *Seaton*, and *Exeter*, is generally allowed; though whether *Leucaro*, *Bomio*, and *Nido*, are to be traced in *Damnonium*, may admit of a future Inquiry. The *Notitia Romana*, ſuppoſed to be written at the End of *Theodoſius* the younger, is indeed ſilent in reſpect to the moſt Weſtern Part of *Britain*, then called *Flavia Cæſarienſis Britannia*, but ſeems principally to regard the Eaſtern and Northern Coaſt, the *Littus Saxonicum*; the *Roman* Soldiers being then withdrawn to theſe Parts, to defend the Iſland againſt the Invaſions of the *Saxons*, and Inroads of the *Picts*.

In the *Chorographia Britanniæ Ravennatis*, ſuppoſed to be compiled by *Gallio*, the laſt *Roman* here with any Command or Forces, we have this Preface: *In Britannia plurimas fuiſſe legimus Civitates & Caſtra, ex quibus aliquantas deſignare volumus, Tamaris, Uxelis, Scadum Namorum, juxta quam civitatem eſt Moriduno*: Allowed by all Commentators to be *Tamerton*, *Leſtwithiel*, *Exeter*, and *Seaton*. Again: *Currunt autem per ipſam Britanniam Flumina plurima, ex quibus aliquanta nominare volumus*, i. e. *Tamaris*, Tamer, *Iſca* Ex, *Tamion* Tavy, *Leuca* Low, *Dorvatium* Dart, *Antrum* Arm, *Vividin* Foy or *Foath* of the *Britains*. Moſt Interpreters allow the *Engliſh* Names agreeably tranſlated to the *Latin*.

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* Which is only a falſe reading for *Isca Dumnunniorum*. *C. M.*

In the *Tabula Theodoſiana* or *Peutingeri*, ſuppoſed to be made about the Time of *Theodoſius the Great*, occur Two Stations, *Iſca Dumnoniorum, Riduno*, which exactly anſwers to *Iſca Dumnoniorum* and *Moriduno* of *Antoninus*.

More might be extracted, to prove that the Geography of *Dumnonium* or *Danmonium*, was well known to the *Romans*. But let us now conſider, that ſince the *Iſca Dumnoniorum* is ſaid by *Ptolemy* to have the *Legio Secunda Auguſta* ſtationed at it, and ſo great and exact Account is given of the *Civitates* (πόλεις) & *Flumina*, in the ſame Author, as well as *Antoninus*, *Chorographia Ravennatis*, and *Tabulæ Peutingeri*, can we ſuppoſe, that the *Romans* could be ignorant of the Tin the Product of *Danmonium*, ſo often mentioned in the *Grecian* Authors? and ſince that their own Name of *Dunmonium* * was by themſelves changed from the *Britiſh*, *Dun Mwyn*, a Hill, or Country of Metals; agreeable to which Etymology we have at this Day a Place abounding in Metals, called *Mwyn*, as *St. Mwyn* Pariſh, within Two Miles of the above-deſcribed *Barrows*. Beſides, it muſt be contrary to Reaſon, and the *Roman* Genius, [*Vita Agric.* Sect. 12.] (*Nobis nec deeſt Avaritia*, ſays *Tacitus*, their own Countryman) to imagine, that the *Romans*, called *Raptores Orbis*, (by the ſame Author) ſhould neglect to hunt after the Metals of Tin and Lead, which were valued as the Rewards of Victory. *Tacitus* has a beautiful Paſſage to this Purpoſe, [*ib.* Sect. 12.] *Fert Britannia Aurum & Argentum, & alia Metalla, pretium Victoriæ*. Again: I hope it will not be tedious to make ſome Extracts out of *Galgacus*'s Speech to his Army, going to encounter the *Roman* Eagle, and when the *Roman* Fleet had ſurrounded and created Terror to *Caledonia: Nullæ ultra Terræ, ac ne mare quidem ſecurum imminente claſſe Romana.—Nunc terminus patet: Romani,—Raptores Orbis,—avari,—& ambitioſi, quos non Oriens, non Occidens ſatiaverit,—bona fortunaſque in tributa egerunt; in annonam frumenta, corpora noſtra ac manus ſilvis & paludibus emuniendis verbera inter & contumelias conterunt;—neque ſunt nobis Arva, aut Metalla, aut Portus, quibus exercendis reſervemur:—hic Dux, & exercitus ibi, tributa, & metalla, & cæteræ ſervientium pœnæ.*—Perhaps the Curious have not ſufficiently remarked this beautiful Speech of *Galgacus*, where he ſo pathetically lays before them the Loſs of their Support, the Metals, for which the *Romans* ſo eagerly fought, and hazarded their Lives, as the expected Reward. He likewiſe relates the Fear created by the Appearance of the *Roman* Fleet on their Coaſts. If we reflect again, that the *Roman* Fleet not only ſailed round *Caledonia*, but alſo the *Dunmonium*, when the *Roman* Ships went to attack the *Silures* in *Wales*; and that the Name *Dun Mwyn*, muſt declare the Product of the Country, as Authors did likewiſe; and that the Second Legion was ſtationed at *Exeter* the Capital City; could the *Romans* in an unuſual Manner ſit idle, and forget their darling Metals, and not penetrate the moſt ſecret Places?

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* Rather *Dunmânium* q. s. Dun mwyn: *ium*. C. *M.*

It will be a Digreſſion, but I hope not an impertinent one, to confute a vulgar Error, that the *Roman* Soldiers made the Highways in *Britain*; when it is plain, that the poor conquered *Britains* under them, as Maſters and Overſeers, *& inter verbera &*

*contumelias*, cauſwayed the Bogs, and pared Woods; *Paludibus & Sylvis emuniendis*, are *Tacitus*'s Words: This was the unhappy State of our conquered Anceſtors the *Britains.*

Much more might be ſaid from the Metals: Let us take a Remark from the Language, and this is one of the Learned Mr. *Edward Llwyd*'s, who ſays, [*Archæol. Brit.* p. 32.] that the *Dunmonian* and other Southern *Britains*, being, on account of their Situation, earlier conquered by, and conſequently more converſant with the *Romans*, than we of *Wales*, it is not to be wondered, if ſeveral *Latin* Words occur in the *Corniſh* Dialect not owned by the *Welſh*, as *Corniſh* Splender, *Latin* Splendor, *Welſh* Eglyrder, *Corniſh* Glitis, *Latin* Glacies, *Welſh* Jâ, *Corniſh* Bovin, *Latin* Bovina, *Welſh* Kigeidon, *&c.*

If we trace the *Romans* by their Remains, as Caſtles, Camps, Coins, Amphitheatres, we may probably be very lucky. Thus we obſerve Three circular Camps or Fortifications within a Mile and half of *Grampound*, the *Voluba*, which lies in the Centre of them. They have a ſingle *Agger*, and a Ditch: In the Rampart of one of them was found an Urn ſome Years ſince, but broken by the Workmen: Another Caſtle *Dennis*, where there is a triple Rampart and Ditches, which has a Cauſway leading to it peculiar to the *Romans*; and I am informed of an Amphitheatre at *Torran* in *Zabulo*: But I ſhall not dwell longer, at preſent, on this Subject; but mention a very weighty Argument from Coins found in the moſt Weſtern Part of *Dunmonium.* The Firſt were found in *Manacon* Pariſh near *Helford* River, and not many Miles from the *Ocrinum Dunmoniorum*, *Lizard-Point.* I have had the Sight but of Three, which are Copper, and of a ſmall Size, very fair and legible: I had them from a Friend at *Falmouth.*

1. *Conſtantinus jun. Nob.* Reverſe *Corona Civica.*
2. *Conſtantius* . . . . . . *Provident Caes.*
3. *Conſtantius Nob.* . . . . . *Gloria Exercitus.*

On the other Side of *Helford* River in the Pariſh of *Conſtantine*, laſt Year, a labouring Man at Plough turned up about Forty, or more: I have ſeen about Thirty of them, Six of which are Silver, and the others Copper. The Silver ones are very fair and beautiful, and about the Bigneſs of a Farthing, or the *Roman Denarius*, and are theſe:

| | Silver. | Reverſe. |
|---|---|---|
| 1. | *Imp. Cæſar Veſp. Aug.* . . . | *Pontif. Maxim.* |
| 2. | *Hadrianus Aug.* . . . . . | *Coſ.* III. |
| 3. | *Divus Antoninus.* . . . . . | *Divo Pio.* |
| 4. | *Imp. Cæſ. Nerva Trajan. Aug.* | *P. M. TR. P.*<br>*Coſ.* III. *P. P.* |
| 5. | *Diva Fauſtina.* . . . . . | . . *ugus* . . other Letters defaced. |
| 6. | *Imp. M. Jul. Philippus Aug.* | *Annona Aug.* |

Copper.

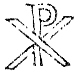
Six in Number, the Size larger than a Halfpeny, and near the Weight of the *Roman As* of half an Ounce, ſcarce legible.

1. *Imp. Cæſar Domit. Aug. Germ. Coſ.* XIII. . . *Auguſti.*
2. *Antoninus Aug.* . . . . . . . . . . .
3. *Nerva Trajan. Aug.* . . . . . . . . . .

The Reverſe not legible, except one Word *Auguſti.* Three more of the ſame Size, intirely defaced.

## Copper Coins.

Five in Number, about the Bigneſs of a Farthing.

1. *Conſtantius Jun. Nob.* Reverſe *Fel. Temp.*
2. *Conſtantius.* . . . . . . . . . . . .
3. Seems to be a Head of *Conſtantine.* {  the *Labarum*, I take, of *Conſtantine.*

The other Two defaced.

Twelve in Number, leſs in Size than a Farthing, or *Triens* or *Quadrans* of the *Roman As*, of which

| | | |
|---|---|---|
| 4 | *Conſtantinus.* | *Gloria Exercitus.* |
| 2 | *Conſtantinus Aug.* | *Votis* x. |
| 1 | *Conſtantinus.* | *Roma.* |
| 1 | *Conſtantinus Jun. Nob.* | *Providentia Cæſ.* |
| 1 | . . . . *Aug.* | *Oriens Aug.* |

Three others not intelligible.

Theſe Coins are in the Cuſtody of my Friend Dr. *Ruſſel* of *Truro.* If I had Leiſure, perhaps I might have been nice in diſcovering the Faces and Reverſes: This Gentleman informs me, that near the Place where the Coins were found, is a circular Camp near *Helford* Harbour.

## DANES.

I could have longer dwelt on this Subject, but have been tedious already: However, muſt not forget the *Danes*, who certainly landed here in *Cornwall*, but by Invitation from the *Britains*, to aſſiſt them to overcome the *Saxons*, and probably never had any Settlement here: They, as Friends, did not want Fortifications for their Defence in *Cornwall*, ſince they went as far as *Exeter* with the *Britains* againſt the *Saxons*, who could never penetrate *Cornwall* till the Ninth Century, when, by one fatal Battle, the *Britains* were obliged to become Tributaries. This

Battle was fought near *Lanelford*. Several Places, I am ſatisfied, ſuppoſed to be *Daniſh* by the Names, never did belong to them. Thus, to inſtance in One, *Carlle Dennis*, which is certainly a *Britiſh* and *Corniſh* Name; *Kaſtelh Ennys*, or *Caſtellyn Enny*, ſignifies a Caſtle on an Iſland, or in the Form of one either moated or trenched round, and here are Three Trenches. Again; *Pendennis* might, for the ſame Reaſon, be reckoned *Daniſh*, when *Pedn*, or *Pen Ennys*, in *Corniſh*, ſignifies the Head of an Iſland, or a Peninſula.

I have endeavoured to trace all the Nations, which could be ſuppoſed to have known *Cornwall*; and muſt leave it at preſent to Gentlemen more learned, to conjecture and diſcover what Nation erected theſe *Tumuli*. My Efforts have been to prove myſelf as worthy a Member as I can, and to thank the ROYAL SOCIETY for the Honour done to me at my Election. If theſe Papers meet with a favourable Reception, it may encourage to proceed farther about the Antiquities in this Country.

*S. Williams*.

## References to TAB. I.

N° I, II, III, IV. *The* Barrows *on the Down, which were opened: In the laſt was found the Urn.*

V. *A* Barrow, *whoſe Poſition reſpects a larger Number, as* N° IV. *does the others lying Eaſtward of it.*

VI. Long Stone.

VII. *St.* Auſtle.

VIII. *The Road to* Grampound, *after its Diviſion near the* Barrows,

IX. *and near* Grampound *it meets the other Branch* (VIII) *again.*

N.B. *There is not any other convenient Road between* Uxella, *Leſtwithiol and* Voluba, *Grampound*

X. *Road to* Uxella, *or Leſtwithiol.*

XI. *Road to* Foy, *or* Vividin.

XII. *A Brook of Water.*

XIII. *Caſtle* Gotha.

XIV. *Hills.*

TAB. II.

Fig. 1. *The Section and Ichnography of* Barrow, N° III.

A. *The Circumference of the* Barrow.
B. *A ſmall Circle of Stones.*
C. *The Body of Stones, which lay over the cylindrical Pit.*
D. *The cylindrical Pit.*
E. *The Earth of the* Barrow.
F. *The Paſſage cut by the Workmen.*
*The Diameter of the* Barrow *was* 46 *Feet.*
*The perpendicular Height* 10½ *Feet.*

Fig. 2. *The Section and Ichnography of* Barrow, N° IV.

A. *The Firſt Circle of Stones.*
B. *Earth.*
C. *The Second Circle of Stones.*
D. *Earth.*
E. *The Centre.*
F. *The oblong Pit.*

G. *The Paſſage cut by the Workmen.*
H. *The Place where the Urn was found.*

Fig. 3. *The Urn.*

*Its Height was* $13\frac{1}{2}$ *Inches.*
*Diameter at the Mouth* 8 *Inches.*
*at the Middle* 11.
*at the Bottom* $6\frac{1}{2}$.

Fig. 4. *The Plan of Caſtle* Gotha.

A. *The Diameter of the Camp,* 100 *Yards.*
B. *The Rampart* [Agger.]
C. *The Ditch, Five Yards deep, and Two Yards broad, which reaches no farther than* D D. *where there is a falling away of the Ground towards the Sea.*

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## IV. *Extracts of Two Letters from Sig*r. Camillo Paderni *at* Rome, *to Mr.* Allan Ramſay, *Painter, in* Covent-Garden, *concerning ſome antient* Statues, Pictures, *and other Curioſities, found in a ſubterraneous Town, lately diſcovered near* Naples. *Tranſlated from the* Italian *by Mr.* Ramſay, *and ſent by him to Mr.* Ward, F. R. S. *Prof.* Rhet. *Greſh.*

*SIR,* *Rome, Nov.* 20. 1739.

YOU may remember, I told you in one of my former Letters, that the King of *Naples* was become a *Virtuoſo,* and had made a Diſcovery of a ſubterraneous Town at *Portici* †, a ſmall Village at the Foot of Mount *Veſuvius*; and that our old Friend Sig^r^ *Gioſeppe Couart*, as Sculptor to the King, had the Care of the Statues found there, with Orders to reſtore them, where they are damaged. Within theſe few Days he is returned hither to ſettle his Affairs, and has informed me of ſome of the Particulars, in ſuch a Manner as very much incites my Curioſity, and Deſire of communicating them to the Public, by making Deſigns of them on the Spot, He tells me, they enter into this Place by a Pit, like a Well, to the Depth of Eighty-eight *Neapolitan* Palms *; and then dig their Way (after the Manner of our *Catacombs*) under the bituminous Matter, thrown out of the Mountain in the Time of great Eruptions, and called by the People of the Country, the *Lava*, which is as hard as a Flint. And when they meet with any thing that ſeems valuable, they pick it out, and leave the reſt. But I am afraid, that after they have ſearched, they throw the Earth in again; by which means many Curioſities may be loſt, not being underſtood by theſe Labourers. They have already found the following Things:

An Amphitheatre, with its Steps.

An Equeſtrian Statue, but all broken to Pieces.

A Chariot and Horſes of Braſs, which have had the ſame Fate.

A large braſen Diſh, ſaid to be found in a Temple.

They have alſo dug out many other Bronzes, with ſeveral Statues and Baſ-relieves, which Sig^r^ *Gioſeppe* is now reſtoring.

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† See theſe *Tranſactions*, N° 456. p. 345.

* A *Neapolitan* Palm contains near Nine Inches.

There have been found likewiſe Eight Rings with their Cornelians engraved, and a Bracelet of Gold.

And they have already taken up about Thirty or more Pieces of antient Painting, ſome of which are exceeding beautiful.

Sigr *Gioſeppe* gave me a Note of the Pictures, but as it is in *Spaniſh*, and wrote in a very bad Hand, I cannot pretend to tranſmit it to you; but chooſe rather to defer it, till I have ſeen them myſelf, which ſhall be as ſoon as I have finiſhed a Piece of Work I am now about, *&c.*

*SIR,* *Rome, Feb.* 20. 1740.

AS ſoon as I arrived at *Naples*, Sigr *Gioſeppe* met me, and carried me to *Portici*. The firſt thing he ſhewed me was the Pictures they had dug out, ſuch as never were ſeen in our Days; and were you to ſee them, you would be ſurpriſed as much as I was; for you would ſee Paintings finiſhed to the higheſt Pitch, coloured to Perfection, and as freſh as if they had been done a Month ago.

Particularly one Piece, Eight Palms broad by Nine high, the Figures as big as the Life, repreſenting *Theſeus* after having killed the *Minotaur*, which is wonderfully fine. You ſee the Figure of *Theſeus* naked and ſtanding, which, in my Opinion, cannot be more properly reſembled to any other thing, than the *Antinous* of the *Belvidera*, both for the Attitude and Air of the Head. It is drawn and coloured with prodigious Elegance. The *Greek* Boys, who are repreſented as returning him Thanks for their Deliverance, ſeem, for their noble Simplicity, the Work of *Dominichino*; and the Compoſition of the Whole is worthy of *Raphael*.

Another Piece repreſents *Chiron* teaching *Achilles* to touch the Lyre.

Another large one, like that of *Theſeus*, the Figures as big as the Life; but we could not comprehend the Deſign of it. You ſee a Woman dreſſed in White ſitting, with one Hand reſting on her Head adorned with a Garland of Flowers, and ſeveral Deities (as they appear to me) in the Air, with a black Figure of *Hercules* leaning upon his Club. This Figure is not of a Piece with the reſt, which are really Prodigies of the Pencil; but yet it is a fine Picture. Under the Woman is a Deer, which gives Suck to a Child. But was you to ſee this ſitting Figure, and the Heads of thoſe whom I take to be Divinities, how finely they are drawn and coloured, you would be aſtoniſhed.

Two other Pieces of greater Height than Breadth, in which there are Two Figures, half Human and half Fiſh, which fly in the Air.

Four Landskips, with Temples, and other Buildings.

Another Figure, which we think to be *Mercury*, with a Child in his Hand, delivering it to a Woman ſitting.

A *Tyger*, with a Boy upon it; and another Boy, who plays on a *Tympanum*: With many others.

After having viewed all theſe things, which are already taken out, I went down into the Pit. The Part where they are at work, muſt have been a ſtupendous Building; and without doubt one may conjecture it to have been an Amphitheatre, by the

Circumference of the Walls, and the large Steps, which are ſtill preſerved. But it is impoſſible to ſee the Symmetry of the Whole; becauſe one muſt travel through ſtreight Paſſages, like our *Catacombs* in *Rome*. After having gone a good Way under-ground, I arrived at the Place in which the Paintings had been diſcovered, and where they are daily diſcovering more. The firſt Miſtake thoſe Men they call Intendants have committed, is, their having dug out the Pictures, without drawing the Situation of the Place, that is, the Niches, where they ſtood: For they were all adorned with Groteſques, compoſed of moſt elegant Maſques, Figures, and Animals; which, not being copied, are gone to Deſtruction, and the like will happen to the reſt. Then, if they meet with any Pieces of Painting not ſo well preſerved as the reſt, they leave them where they found them. Beſides, there are Pillars of *Stucco* extremely curious, conſiſting of many Sides, all variouſly painted, of which they do not preſerve the leaſt Memory. But what is moſt curious, is to ſee theſe Paintings all covered with Earth, which when taken off, they appear to have ſuffered nothing by it. I believe this may be accounted for, by there being no Damp or Moiſture in the Place; and that the dry Earth has been rather preſervative, than hurtful to them. The antient Beams are yet diſcernible, but they are become like Charcoal. And I have ſeen there a Place where antiently they kept Lime for building; a great Quantity of which yet remains as freſh as if made but Yeſterday. In a word, perceiving all thoſe who are called Superintendants of this Affair, wholly ignorant of what they are about, I began to ſuffer in a very ſenſible Manner; ſo that every Day appeared a Month, till I ſhould deliver my Letter, and ſee what Succeſs it would meet with. For had it ſucceeded, I ſhould have gone immediately, and drawn thoſe Things, which, not being taken care of, though of great Curioſity and Erudition, will ſoon be deſtroyed.——However, as I could do nothing more, and having a great Concern for thoſe fine Things in a periſhing Condition, I left them a Paper of Directions how to manage. If they do not obſerve them, the greater Misfortune will be ours, to hear that what Time, Earthquakes, and the Ravages of the Volcano have ſpared, are now deſtroyed by thoſe who pretend to have the Care of them, *&c.*

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## V. *Extract of a Letter from Mr.* George Knapton *to Mr.* Charles Knapton, *upon the ſame Subject.*

I Shall not trouble you with any Account of the Curioſities of *Naples*, they being ſo well known, only of one which is ſomething out of the common Way, the antient City of *Herculaneum*, which was ſwallowed up by an Earthquake. It is now under a Town called *Portici*, a quarter of a Mile from the Sea, at the Foot of *Veſuvius*; and has no other Road to it, but that of the Town-well, which is none of the moſt agreeable, being in ſome Parts very ſtreight, in others wide, and cut in a moſt rude Manner. Toward the Bottom, where you go into the City, it is very broad, which they have made ſo, to turn the

Columns, which were brought up: For I ſpoke to an old Man, living next Door to the Well, who told me, he was one of thoſe employed in digging there; and that they began 27 Years ago, and worked Five Years: That the beſt Part of the Duke *di Belboſi*'s preſent Eſtate was found there; the moſt principal Things were, Two Columns of Oriental Alabaſter, which were ſold for 50,000 Ducats: That they had found alſo many fine Statues, the beſt of which were ſold, and ſome he had ſent to *Lorraine*. I ſaw Five, which they have put up in the Market-place, all clothed Figures, one in a Conſular Habit, the others Women: They are all well dreſt, and in a fine Taſte, but want the Heads. In the Duke's *Villa*, which is near and by the Sea-ſide, are Two others intire, both Women; one ſeems to be a *Livia*: Alſo the Fragments of a naked Figure, which wants the Head and Arms, of a good Style. Theſe, with ſome Ornaments and Fragments of various ſorts of Marbles, are all that is to be ſeen there, of what has been dug up.

Having given you ſome Account of what is taken out of this ſubterraneous City, I ſhall now proceed to what remains in it, and our Journey down to it. At our coming to the Well, which is in a ſmall Square, ſurrounded with miſerable Houſes, filled with miſerable ugly old Women, they ſoon gathered about us, wondering what brought us thither; but when the Men who were with us, broke away the paltry Machine with which they uſed to draw up ſmall Buckets of Water, I thought we ſhould have been ſtoned by them: Till, perceiving one more furious than the reſt, whom we found to be *Padrona* of the Well, by applying a ſmall Bit of Money to her, we made a ſhift to quiet the Tumult. Our having all the Tackle for deſcending to ſeek, gave Time for all the Town to gather round us, which was very troubleſome: For, when any one offered to go down, he was prevented either by a Wife, or a Mother; ſo that we were forced to ſeek a motherleſs Batchelor to go firſt. It being very difficult for the Firſt to get in, the Well being very broad at that Part, ſo that they were obliged to ſwing him in, and the People above making ſuch a Noiſe, that the Man in the Well could not be heard, obliged our Company to draw their Swords, and threaten any who ſpoke with Death. This cauſed a Silence, after which our Guide was ſoon landed ſafe, who pulled us in by the Legs, as we came down. The Entrance is 82 Feet from the Top of the Well: It is large, and branches out into many Ways, which they have cut. We were forced to mark with Chalk, when we came to any Turning, to prevent loſing ourſelves. It gives one a perfect Idea of a City deſtroyed in that Manner: For one there ſees great Quantities of Timber, in the Form of Beams and Rafters, ſome lying one Way, ſome another; ſome, as they broke in the Fall, others intire: Theſe are ſticking in the Sides of the Ways, and are become a perfect Charcoal; but thoſe in moiſt Places, and where the Water ouſes, you may run your Hand into, and work like a Paſte, and they have more the Colour of rotten Wood. The Walls are ſome tumbled ſlanting, others croſſing them, and many are upright. One ſees great Quantities of Marble, as Bits of Window-caſes and other Ornaments, ſticking out on all Parts. There ſeem to be, in one Place, the Ruins of ſome magnificent Building, which they have dug round; for there appear the Baſes in white Marble of ſquare and round Columns, which are all of a Size; and, what is ſurpriſing, they have not examined whether they have any Columns on them, which one Stroke of the Pick-ax would have done. I ſcraped away the Earth at the Side of the Baſe of a Pilaſter, and found the Wall covered with a very beautiful Marble, but could not reach to diſcover what was on the Top of it. There are but Two Columns that appear, one of a red Marble, the other of Brick covered with Stucco, and fluted. In one Place there are about 14 Steps, which reſembled the Seats of a Theatre. Some of the Walls have the Plaſter remaining, and are painted, the Colours ſtill freſh. *We found many Ways filled up, which they had done to ſave the Trouble of carrying out the Earth.* I obſerved that they had not gone near the Bottom of the Ruins, for fear, I ſuppoſe, of the Springs; for in ſome Parts they ſeem to be as low as the Water in the Well. One ſees nothing but pure Earth mixed with theſe Ruins; whereas the Surface of all that Part of the Country, quite to the Sea, is covered with the Cinders of *Veſuvius*. One ſees the Buildings were of Brick covered with Marble; for I found no other ſort of Stone there, but thin Plates of Marble of all ſorts in great Quantity. Neither are there any Baſes or Capitals of large Columns; Two Feet Diameter is the moſt. Captain *Emmory* brought away a ſmall Capital of a Pilaſter, which is very curious; it being much the ſame as was uſed by the *Goths* in *Italy*. This makes me think, that they revived the antient barbarous Style, uſed before the Introduction of the *Greek*, for the Capital: This is certainly more antient than the Time of the *Goths* in *Italy*. It was the only one of the kind we ſaw there.

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## VI. *Extract of a Letter from Mr.* Criſpe *to Mr.* George Knapton, *upon the ſame Subject as the Two preceding Papers.*

*Rome*, *April* 24. 1740.

AT *Portici* I ſaw ſome antique Paintings, which have lately been taken out of the Ruins of *Herculaneum*: Two of them, about 12 Feet Square, with their painted Frames or Borders round them, are as freſh and perfect as if done Yeſterday; much more ſo, I aſſure you, than ſome of *Raphael's* in the *Vatican*; and for Excellence, and fine Taſte, they are, I think, beyond any thing I have ſeen. One of theſe is called the *Pomona*, becauſe, among other Figures, there is a Woman ſitting crowned with Fruits and Bloſſoms. The other is *Theſeus*, having juſt killed the *Minotaur*, who lies dead at his Feet; a Figure of a Youth is kiſſing his Right Hand; *Ariadne* and another Figure ſtand at his Left. The Figures in both theſe are as big as Life. There is a Third, ſomewhat leſs, of *Chiron* teaching *Achilles* on the Harp, if poſſible, ſtill beyond the Two former. There are above 50 other Pieces, ſome whole Figures, ſome Heads, ſome *Maſcheras*, ſome Landskips, ſome Architecture.

I was to viſit the Ruins under-ground, where I ſaw ſeveral Pieces that were taking down; particularly one 15 Feet wide, and Eight high: It conſiſts of the Front of a large Temple, with Buildings of the ſame Architecture projecting on each Side, in the Nature of the Wings of a Houſe. There are Houſes alſo adjoining to this Temple, with Windows divided into Squares, which Squares are painted of a greyiſh Colour: I will not pretend to ſay, this is to repreſent Glaſs, becauſe I believe we have no Authority for it in any Author of Antiquity: But I tell you the Fact as it is, and among the *Virtuoſi* of your Acquaintance you may find out the Meaning. I muſt obſerve to you, that in this Architecture the Perſpective is very exact; which one may judge of with a good deal of Certainty in thoſe Wings which project. The Architecture is very rich and noble: The *Clair-Obſcur* likewiſe in the other Pictures, is well underſtood; particularly in the *Pomona,* where there are Six Figures, which are very agreeably grouped, and the Eye is immediately pleaſed and repoſed. They have dug up a good many Statues, but not above One or Two that are tolerably good. There is, however, a perfect Buſt of *Agrippina,* Mother of *Nero,* which was found ſtanding in its Niche: It is as clean as if juſt finiſhed, has not the leaſt Damage, and is, in the Judgment of every body, as well as myſelf, equal to moſt things of that kind in the World: For my own Part, I ſhould not ſtick to ſay, it is altogether as fine a Portrait as the *Caracalla* of the *Farneſe.* There are Two Equeſtrian Statues in Bronze, broken all to Pieces, but which, by the Parts, one may judge to be as big as the *Marcus Aurelius:* They are ſoon to be put together. They have found ſeveral antique Rings, with *Cameo's* and *Intaglia's* ſet in them; a

Fork, a Silver Spoon, made in the Handle like a modern one; the Bowl is pointed like an Olive-leaf; a Caſe of Surgeon's Inſtruments, ſeveral Kitchen Utenſils, Mouſe-traps, Veſſels full of Rice, a Triumphal Car of Bronze, *&c.*

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## VII. *A remarkable Cure performed by* John Cagua, *Surgeon, at* Plymouth-Dock, *of a* Wound *of the* Head *complicated with a large* Fracture *and* Depreſſion *of the Skull, the* Dura Mater *and* Brain *wounded and lacerated: Communicated in a Letter to* William Cheſelden, *Eſq*; F. R. S. *&c.*

*JUNE* 11. 1729. I was ſent for to Mr. *John Darton* of *Stonehouſe* near *Plymouth*, to ſee his Son, aged 10 Years, who fell down from the Top of an old Wall, as he was taking out a *Sparrow's* Neſt, upwards of 20 Feet high, in an antient Building belonging to the Honourable *Richard Edgecumbe*, Eſq;. When I came, I found him ſpeechleſs, *comatoſe*, bloated Eyes, a wan Face, bleeding at the Noſe and Ears, and a great *Hæmorrhage* and Vomiting: On Examination, a large, long, deep, and contuſed Wound appeared, from the Eyebrow all over the Left Side of his Head; and after having ſhaved him, was ſurpriſed to feel, with my Fingers, ſo many rugged Splinters of the *Cranium* confuſedly depreſſed through the *Dura* and *Pia Mater* into the Subſtance of the Brain; the Extremities whereof ap-

appearing above the *Dura Mater*, I extracted to the Number of Five, as they are repreſented in the Draught (*ſee* TAB. IV.) in their proper Bigneſs and Figures, beſides ſeveral other Bits and ſmall Pieces: In taking out the laſt Splinter, being Part of the ſuperior and interior Part of the Orbit, containing ſome of the Baſis and inferior Part of the *Os Frontis*, joining by the *Sutura Tranſverſalis* to the ſuperior Part of the *Os Malæ*, with Part of the ſaid *Suture* and the upper Extremity of the *Sphenoides*, almoſt to the lower End of the *Sutura Coronalis* and *Squamoſa*: This Splinter was the major Part of it depreſſed under the ſuperior Part of the great Depreſſion of the *Os Frontis*; on extracting of which, Two Parts or Pieces of the Subſtance of the Brain, with clotted Blood, came out with it, one as big as a large Kidney Bean, and the other as a large Pea; at which Time the Patient fainting and vomiting, brought up moſt of what was contained in his Stomach, mixed with bilious and bloody Matter. The *Dura Mater* was very much contuſed, lacerated, and bare, upwards of Three Inches and a quarter in Length, and at one End One Inch and a half over, the Remainder about One Inch, and the Edges rugged: From the upper Part of the Fracture, there was a Depreſſion of the *Os Frontis*, which reached up to the *Sutura Sagittalis*, nigh the *Coronal Suture*: One Part of the *Cranium* lapt over the other, which I ſawed off on the Third or Fourth Day, it being an Inch long, and occaſioned me a great deal of Trouble, before I could raiſe it up with my Elevator, the inferior Part of the Fracture being ſo thin and weak: The depreſſed Part terminated in a long Fiſſure, about an Inch behind the *Coronal Su-*

*ture* in the *Bregma*: The *Scalp* was ſo much contuſed and laccrated, that the next Day it began to mortify, which obliged me to lay all that Side of the *Coronal*, and the greateſt Part of the *Bregma*, home to the *Lamdoid Suture*, bare, from the upper Part of his Head down to his Ear (as in TAB. III.): The *Dura* and *Pia Mater* were very livid, and inſenſible to the Touch, except thoſe Parts where the Brain was wounded, in the dreſſing of which the Motion or Pulſation of the Brain was very ſtrong, and ſometimes to that Degree, that it would riſe conſiderably above the Surface of the *Cranium*; which obliged me to keep it down ſometimes more than Two or Three Minutes with my Fingers, and a large and thick Sindon dipt in a warm detergent Lotion, before it would ceaſe, introducing it between the *Dura Mater* and the Edges of the Fracture. The upper Eye-lid in a Week's time impoſtumated, and formed a large Tumor as big as a Hen's Egg, which I opened, and kept it ſo a conſiderable Time, becauſe I had therefrom a plentiful Diſcharge of Matter, which was at firſt very fetid, but afterwards became laudable, giving likewiſe a good Diſcharge from the wounded Brain through the Fracture of the upper Part of the Orbit. In about a Fortnight's time I had a very laudable Suppuration from all the Wound, and the Symptoms ceaſing, the *Dura Mater* began to regenerate, looking very red and freſh; the livid and lacerated Parts ſluft off, and the Extremities of the Fracture began to throw out their Oſſifications from the *Diploe* and both Tables of the *Cranium*, like ſmall Excreſcences, or proud Fleſh, which in a Month's time ſpread over the whole Fracture; and I made my Obſervation, that it grew harder ſooner at the Extremities of the Fracture than in the Centre The Motions or Pulſations of the Brain ſtill continued, and were very viſible for a long Time after, and were felt for ſome time after the Wound was cured; eſpecially in the inferior Part of the *Coronal* and *Bregma*, over the inferior Part of the *Coronal Suture*, nigh the *Syneuroſis*. Except the Three or Four firſt Days, the Boy continued very ſenſible; but during the firſt Six Weeks would very often complain of a violent Pain in his Head, attended with a *Comatoſe*, and Fever; but would ſoon go off again, by giving him an emollient and laxative Clyſter, or a gentle laxative Draught. The 6th of *October* following, before his Wound was quite well, he was taken very ill with the Small-pox, of the *Flux-kind*, and though he had them very ſevere, and delirious in their coming out, yet recovered. The 11th of *November* following, the Wound was perfectly cured; but in the latter End ſeveral Exfoliations were taken out of the upper Part of the *Coronal*. He is now, and hath been ever ſince, very well, ſtrong and healthy; has his Sight in both Eyes, is a very ſenſible and forward Lad, for his Age, and has been upwards of Four Years at Sea, in his MAJESTY's and the Merchants Services.

Plymouth-Dock,
March 1. 1736.

*John Cagua.*

TAB. III.

*Repreſents the Boy's Head, with the Wound, as it appeared to View, and Part of the* Cranium *laid bare.*

## Tab. IV.

*Repreſents the Skull, with the Fractures made in it, and the ſeveral Splinters, that were taken out.*

A . . . *Is the external Part of the Splinter, adjacent to the ſuperior Part of the* Os Malæ, *and the upper Part of the Orbit, in its proper Bigneſs and Figure.*

1. *Is the thick Protuberance of the Baſis and inferior Part of the* Os Frontis, *broke off and ſeparated from the ſuperior Extremity of the* Os Malæ *in the tranſverſe* Suture.
2. *Is the lower Part of it broke off from the upper Part of the* Os Sphenoides.
3. *Is Part of the* Sutura Tranſverſalis.
4. *Is the* Diploe, *and its Thickneſs, being very rugged and irregular.*

B . . . *Is the internal and concave Parts, with the Thickneſs of the ſame Splinter.*

1. *Is Part of the Concavity of the upper Part of the Orbit.*
2. *The ſuperior Part, with its Thickneſs and* Diploe.

6 *and* 7. *The external and internal Tables.*

3. *The inferior and internal Part ſeparated from the* Os Sphenoides: *The Middle of it is a deep Concavity.*

4. 4. *A rugged Ridge ariſing from its Cavity, and likewiſe from the great and middle one.*

5. *The internal and concave Part.*

8. 8. *Part of the* Sutura Tranſverſalis.

C... *Is Part of the inferior and Baſis of the* Os Frontis *and* Bregma, *with ſome of the lower Part of the* Sutura Coronalis; *being very thin in the Middle where the* Suture *is, it ſhews its proper Bigneſs and Figure.*

1. *The* Diploe.

D. D. D. *Three other Splinters in their proper Bigneſſes and Figures.*

1. 1. 1. *The* Diploe *and both Tables.*

E... *The Splinter that lapt over the Depreſſion, which was ſawed off.*

F. The Stone mentioned in the next Paper.

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## VIII. *A Caſe communicated by Mr.* J. Mackarneſs, *Apothecary, in* Chipping-Norton, *in* Oxfordſhire, *of an extraordinary* Stone *voided by the* Anus.

MRS. *Mary Smith*, Wife of *John Smith*, of *Chadlington* in the County of *Oxon*, aged about 31, a tall well-ſhaped ſtrong-made Woman, was ſeized with a violent Fever, accompanied with great Heat, Reſtleſſneſs, Pain in the Head, Twitchings of the Tendons, pale Urine, unequal Pulſe, Difficulty of breathing, great Coſtiveneſs, and without Thirſt. She had a hard Labour about three Weeks before. This Fever ſeized her the 2d of *January* 1727. and laſted till the 17th, during which Time ſhe was very coſtive, and continued ſo till ſhe had another Child, which was the latter End of *February* 1728. and was frequently ſubject to Attacks of a Fever, notwithſtanding ſhe obſerved a moſt regular Temperance: Her Labour was always difficult, and ſhe bred her Children very faſt: She lay in again in *December* 1728. and in *May* 1731. and the Child ſhe lay in with at this Time had a hollow Dent above the Temples, on the Left Side of the Head, and is now living. She lay in again in *September* 1732. and in *October* 1733. Theſe Two laſt Labours were the moſt violent, and the Children had both Dents in the ſame Place of the Head, the laſt the biggeſt, the Hollow being big enough to contain half a ſmall *Orange*; and the Two Children were ſtill-born, but alive till the Moment they came to the Birth. In *December* 1733. ſhe was ſeized with a Fever, and violent Pains croſs her Loyns and Back, great Coſtiveneſs, Pain at the Neck of the Bladder, and a Pain and Heavineſs about the Region of the *Os Pubis*. I took ſome Blood from her, gave her ſoft gentle Purges, with the intermediate Uſe of balſamic and diuretic oleaginous Mixtures and Apozems; but it was difficult to get any common Doſe of purgative Medicines to work with her: I then had recourſe to Clyſters, but all without any Effect, except that her Fever remitted; but ſhe had no Relief from her Pains, and her Coſtiveneſs increaſed, having no Stool but what was from Purges or Clyſters, or both; and the Excrements that came from her were formed in a very odd Figure, like the Leaves of the great *Houſe-leek*, in *Strata*, one on the other; and thus ſhe was for ſeveral Months, and then her Urine began to grow fetid, and a ſlimy Subſtance fell to the Bottom of the Pot: Her Pains ſtill continued; ſhe found no Relief from any Medicines, except

Opiates; and theſe I was obliged to uſe but ſeldom, becauſe of her Coſtiveneſs. The Stench of her Urine increaſed, and now a purulent Matter diſcharged itſelf in great Quantity: I concluded ſhe had an Ulcer in the Bladder: Mr. *Wiſdom*, a neighbouring Surgeon, paſſed a Catheter into the Bladder, and he perceived a Swelling juſt above the Groin, in the Left *Hypochondre*, which was very hard: We adviſed her to Patience and Reſignation, in hopes Nature might point out ſome Method for her Relief; and gave her no more Medicines, but a ſoluble Electuary to procure her Stools, which ſhe took every Night. After ſome Time, the fetid purulent Matter ceaſed from diſcharging itſelf in the Urine, but came away through the *Vagina*, after the manner of the Whites. She was quite emaciated, and grown to a Skeleton, by continual Pain, and thoſe Diſcharges. In *April* 1735. another Turn happened: That purulent fetid Matter, which diſcharged itſelf at the *Vagina*, now came through the *Anus*; ſhe complained of a prodigious Weight there, and about the Middle of *June* 1735. ſhe had frequently very bloody Stools, and once a Diſcharge of more than half a Pint of freſh Blood. On the 2d of *July*, having Occaſion to go to the Cloſe-ſtool, as ſhe ſat there hard ſtraining, but to no Purpoſe, ſhe thought ſhe felt a hard Subſtance ready for Expulſion, and ſent for her Neighbours, who found a large Subſtance hard and rugged, (ſo much, that it tore one of the Womens Fingers, and made it bleed) in the lower Part of the Gut *Rectum*, cloſe to the *Sphincter Ani*. Mr. *Wiſdom*, the Surgeon, was immediately called, who endeavoured to extract this Subſtance, and broke ſome Part of it off, but was forced to dilate the *Rectum*, and ſo extract it that Way. It was a hard unequal ragged flinty Stone, [*ſee the Figure of it in* TAB. IV. *at* F.] was Ten Inches and an half round, and weighed Eight Ounces and an half, after it was extracted. The Woman has been eaſy from that Moment; the Wounds, by the Care and Skill of her Chirurgions, are healed; ſhe goes about her Buſineſs, has got a good deal of Fleſh, and is recovered perfectly, except a Numbneſs and Contraction ſhe has in ſome of her Fingers of both Hands, and both Feet and Toes.

*J. Mackarneſs.*

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## IX. *An Account of Mr.* Leeuwenhoek's *Microſcopes; by Mr.* Henry Baker, F. R. S.

HAving been favoured by this Illuſtrious SOCIETY with an Opportunity of examining the much-talked-of Microſcopes of the famous Mr. *Leeuwenhoek*, who, by his Glaſſes, made ſuch wonderful Diſcoveries in the *Minutiæ* of Nature, as have laid the Foundation of a Philoſophy unknown to preceding Ages; I think it incumbent on me to ſhew the Uſe I have been making of them.

Upon opening the Cabinet that contains theſe Microſcopes, I laid before me an Account of them, drawn up, and preſented to this SOCIETY, ſome Years ago, by its preſent worthy Vice-Preſident *Martin*

*Martin Folkes*, Eſq; * and found it ſuch an exact and full Deſcription of their Structure and Uſes, as renders any further Attempt to that Purpoſe intirely needleſs. I had likewiſe the Pleaſure to find, that the judicious Obſervations of this Gentleman, on the Goodneſs of the Glaſſes, and the admirable Dexterity of Mr. *Leeuwenhoek* in the Management and Application of the Objects fitted to them, had reduced my Taſk to ſo narrow a Compaſs, that little more is left for me to offer than a Calculation of their magnifying Powers, ſome Reflections ariſing from ſuch Calculations, and a brief Account of what Improvements in Microſcopes have lately been made amongſt us.

In order to this, the firſt thing I went about, was to view attentively the Objects applied to theſe Microſcopes by Mr. *Leeuwenhoek* himſelf, which Mr. *Folkes* has given a Liſt of in his Account; but the greateſt Part of them were, I found, deſtroyed by Time, or ſtruck off by Accident; which indeed is no Wonder, as they were only glewed on a Pin's Point, and left quite unguarded. Nine or Ten of them, however, are ſtill remaining; which, after cleaning the Glaſſes, appeared extremely plain and diſtinct, and proved the great Skill of Mr. *Leeuwenhoek*, in adapting his Objects to ſuch Magnifiers as would ſhew them beſt, as well as in the Contrivance of the Apertures to his Glaſſes, which, when the Object was tranſparent, he made exceeding ſmall, ſince much Light in that Caſe would be prejudicial: But, when the Object itſelf was dark, he inlarged the Aperture, to give it all poſſible Advantage of the Light.—The Lens being ſet ſo as to be brought cloſe to the Eye, is alſo of great Uſe, ſince thereby a larger Part of the Object may be ſeen at one View.

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* *Philoſophical Tranſactions*, N°380.

It muſt be remembered, that all theſe Microſcopes are of one and the ſame Structure, and that the moſt ſimple poſſible, being only a ſingle Lens, with a moveable Pin before it, on which to fix the Object, and bring it to the Eye at Pleaſure.

Though I was ſenſible it muſt coſt much Trouble to meaſure the focal Diſtances of theſe 26 Microſcopes, and thereby aſcertain their Powers of magnifying, I conſidered that, without ſo doing, it would be impoſſible to form a right Judgment of them, or make any reaſonable Compariſon between them and our own. This Task therefore I have performed, with as much Care and Exactneſs as I was able; and have ſhewn, in the following Table, how many of them have the ſame Focus, and conſequently magnify in the ſame Degree; how many times they magnify the Diameter, and how many times the Superficies of any Objects applied to them. I have given the Calculations in round Numbers, the Fractions making but an inconſiderable Difference; and hope any Miſtakes I may have made in ſo nice a Matter will be excuſed.

*A* Table *of the* Focal Diſtances *of Mr.* Leeuwenhoek's 26 *Microſcopes, calculated by an Inch Scale divided into* 100 *Parts; with a Computation of their magnifying Powers, to an Eye that ſees ſmall Objects at* 8 *Inches, which is the common Standard.*

| Microſcopes with the ſame Focus. | Diſtance of the Focus. | Power of magnifying the Diameter of an Object. | Power of magnifying the Superficies. |
|---|---|---|---|
| | *Parts of an Inch.* | *Times.* | *Times.* |
| * 1. | $\frac{1}{20}$ or $\frac{5}{100}$ | 160 | 25600. |
| 1. | $\frac{6}{100}$ | 133 nearly. | 17689. |
| 1. | $\frac{7}{100}$ | 114 nearly. | 12996. |
| 3. | $\frac{8}{100}$ | 100. | 10000. |
| 3. | $\frac{9}{100}$ | 89 almoſt. | 7921 almoſt. |
| 8. | $\frac{1}{10}$ | 80. | 6400. |
| 2. | $\frac{11}{100}$ | 72 ſomething more. | 5184 ſomething more. |
| 3. | $\frac{12}{100}$ | 66 nearly. | 4356 nearly. |
| 2. | $\frac{14}{100}$ | 57 | 3249. |
| 1. | $\frac{15}{100}$ | 53 nearly. | 2809 nearly. |
| 1. | $\frac{1}{5}$ | 40. | 1600. |
| 26. | | | |

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* This largeſt Magnifier of all is in the Box marked 25.

It appears, by the foregoing Table, that One only of theſe 26 Microſcopes is able to magnify the Diameter of an Object 160, and its Superficies 25600 times; all the reſt falling much ſhort of that Degree. And therefore, I am fully perſuaded, and believe I ſhall be able to prove, that many of the Diſcoveries Mr. *Leeuwenhoek* gives an Account of, could not poſſibly be made by Glaſſes that magnify no more than this.

I beg Leave to obſerve, that our Cabinet is but the Second in Mr. *Leeuwenhoek*'s Collection, and is very far from containing all the Microſcopes he had, as many wrongly have imagined. We find here indeed, 26 Microſcopes in 13 little Boxes: Each Box contains a Couple of them, and is marked in Two Places with a Number, to diſtinguiſh it from the reſt. But as the firſt of theſe Boxes is marked 15, and the reſt with following Numbers on to 27; it neceſſarily implies there were 14 preceding Boxes, ſince no Man begins with the Number 15.——Mr. *Leeuwenhoek*, then, had another Cabinet, that held 14 Boxes before ours in numerical Order, and probably each Box contained a Couple of Microſcopes, as our Boxes do. But, beſides theſe Two Cabinets, he had ſeveral other Microſcopes of different Sorts, as his own Writings will make appear.

The Cabinet now before us ſeems to have been only his Repoſitory of Objects; for every Microſcope herein was engaged by an Object affixed to it, and thereby rendered uſeleſs for any other Purpoſe; whereas thoſe he employed in his daily Obſervations muſt have been always ready, and at full Liberty, to examine whatever offered. Many of them too muſt certainly have been much greater Magnifiers than any in our Poſſeſſion.——And we are aſſured by himſelf, that ſuch he had; for he often mentions his ſhifting Objects from his common to his better, and thence to his moſt exquiſite Microſcopes: And, beſides, (in the Second Volume of his Works, Part IId. pag. 290.) he ſays, “ *Mihi quidem ſunt centum* “ *centumque Microſcopia*, &c. “ I have an hundred “ and an hundred Microſcopes, moſt whereof are “ able to ſhew Objects ſo diſtinctly, even in the “ cloudieſt Weather, and by Day-light only, that if “ the *Animalcula in Semine maſculino* of Animals “ had the Extremity of their Tails forked, (as de- “ ſcribed by a certain Writer) I ſhould eaſily have “ diſcovered it.”——Among this Number, many, without doubt, were contrived for the Examination of Fluids, ſince great Part of his Obſervations were made on them: He informs us alſo, that his Method was to put them into an exceeding ſmall or capillary Tube of Glaſs, which there does not ſeem to be any Means of applying to the Microſcopes in our Cabinet, even had they been at Liberty; and much leſs for the larger Tubes he made uſe of to view the Circulation of the Blood in *Frogs*, *Eels*, *Fiſhes*, *&c.* his Apparatus for which we find in the Fourth Volume of his Works, pag. 180.——But to proceed:

Mr. *Leeuwenhoek*, in a Letter to this SOCIETY concerning the *Animalcula* obſerved by him in the *Semen maſculinum* of a *Dog*, which he deſcribes and gives a Draught of, ſays, they were ſo minute, that he believed a Million of them would not equal the Size of One large Grain of Sand. Vol. I. Part I. pag. 160. Again, in his 113th Letter, ſpeaking of the *Semen*

*Semen virile*, he declares, that a Million of the *Animalcula* ſeen therein would not equal a large Grain of Sand; and yet he gives a full Deſcription of their Form; for he ſays, their Bodies are roundiſh, ſomewhat flat before, but ending ſharp behind, with Tails exceedingly tranſparent, Five or Six times longer, and about Five times ſlenderer, than their Bodies; ſo that their Figure cannot better be repreſented, than by a ſmall *Earth-nut* with a long Root or Tail.

Now the Focus of the greateſt Magnifier of his being $\frac{1}{20}$ of an Inch, as near as can well be meaſured, it is capable of magnifying the Diameter of an Object (to an Eye that ſees ſmall Objects beſt at Eight Inches) no more than 160, and the Superficies 25600 times: So that Objects, One Million whereof ſcarce equal a Grain of Sand, viewed through ſuch a Lens, (as only the Superficies can be ſeen) could appear no larger than Two Grains and half of Sand would be to the naked Eye; and I ſubmit it to be conſidered, whether that is not too ſmall a Size for any Man to deſcribe ſo particularly, and delineate the Form and Parts of.

But Mr. *Leeuwenhoek* goes yet abundantly farther: For, to mention only one Inſtance, of which there are ſeveral in his Writings; he tells this SOCIETY in his Letter of *July* 25. 1684. that he could diſcern Veſſels in the human Eye, ſo amazingly minute, that, deſiring to know their Smalneſs, he meaſured them by the Diameter of a Grain of Sand, (the Proceſs of which Menſuration is there ſet down) and found by arithmetical Calculation, that a large Grain of Sand muſt be divided into * Eighteen thouſand Three hundred Ninety-nine Millions Seven hundred Forty-four thouſand Parts, ere it can be ſmall enough to enter theſe minute Veſſels.——What ſhall we now ſay?——Why, in regard to the Memory of this great Man, to whom the World, and this SOCIETY, are much obliged, I muſt inſiſt, that he certainly had Glaſſes, that were much greater Magnifiers than any we have of his.

It may perhaps be objected, that Mr. *Leeuwenhoek* declares, he did not uſe ſuch ſmall Glaſſes as ſome People boaſted of; and that, although for 40 Years together he had been poſſeſſed of Glaſſes exceedingly minute, he had employed them very ſeldom; ſince, in his Opinion, they could not ſo well ſerve to make the firſt Diſcoveries of Things, as thoſe of a larger Diameter. In Anſwer to this, I muſt beg Leave to obſerve, that Mr. *Leeuwenhoek*, in this Place, is reflecting on a certain Phyſician, who boaſted of an extraordinary † Microſcope ſcarce bigger than a viſible Point, whereby he pretended to diſcover the *Animalcules in Semine virili* to be exactly of an human Shape, with only a Skin over it. For he ſays, that while he was attentively obſerving theſe *Animalcules*, one of them (a little bigger than the reſt) preſented itſelf, having almoſt ſlipped off its Skin: And then there plainly appeared Two naked Thighs and Legs, a Breaſt, and Two Arms, above which, the Skin being thruſt up, covered the Head as it were a Cap.

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[*] Vol. I. p. 39.

[†] Epiſt. 116. Vol. II. Part II. pag. 84.

The Sex he confeſſes he could not diſtinguiſh, and adds, that it died in endeavouring to get clear of the Skin.

Mr. *Leeuwenhoek* very juſtly expoſes this romantic Diſcovery, pretended to be made by this Speck of a Microſcope; and takes occaſion therefrom to let us know, he does not think ſuch minute Glaſſes are ſo much to be depended on as thoſe of a larger Diameter. But there are ſo many Degrees between the ſmalleſt Glaſs we have of his, (whoſe Focus is at $\frac{1}{20}$ of an Inch) and this almoſt inviſible Point, that we muſt not infer from hence he uſed none of a Size between. Nay, this very Letter ſeems to imply the contrary; for it tells us, that, in examining the *Semen virile*, he made uſe of Eight or Ten Microſcopes of different magnifying Powers: But as all the Microſcopes we have of his, have Objects faſtened to them, and beſides have no Apparatus for Fluids, I think they could not probably be the ſame he employed for that Examination. May we not rather ſuppoſe he had Eight or Ten different Sizes of Microſcopes, that magnified more than ours? For we know, Fluids require to be examinined by the greateſt Magnifiers; and doubtleſs he made uſe of ſuch for that Purpoſe.

There is no Advantage in employing a greater Magnifier for any Object, than what is requiſite to ſhew the ſame diſtinctly; but when the Object is exceedingly minute, the magnifying Power of the Glaſs muſt be proportionably great, or elſe it will be impoſſible to ſee the Object clearly. A Lens, (for Example) that ſhews a whole *Flea* diſtinctly, magnifies not near enough to ſhew the *Animalcules* in the *Semen* of that *Flea.*

I am ſenſible, that Mr. *Leeuwenhoek*, by long Practice, and uncommon Attention, might be able to diſcern many Objects with theſe Microſcopes, which others, leſs accuſtomed to Obſervations of this kind, cannot readily do: His Eyes too might be ſomewhat different from the Standard I meaſure by. But all theſe Allowances will not, I think, ſuffice to reconcile the Paſſages I have quoted with the Powers of the Glaſſes under Examination.

While I was overlooking theſe Microſcopes of Mr. *Leeuwenhoek*, an Opportunity preſented of examining and comparing with them a curious Apparatus of Silver with Six different Magnifiers, belonging to Mr. *Folkes*, and then newly made for him by Mr. *Cuff*, in *Fleetſtreet.*——The Body of this Inſtrument, into which the Glaſſes are occaſionally to be faſtened, is after the Faſhion of *Wilſon's* Pocket Microſcope, and contrived to ſcrew into the Side of a Scroll fixed on a Pedeſtal, from which a turning *Speculum* reflects the Light upwards upon the Object: It is likewiſe contrived to be uſed with the Apparatus of the Solar Microſcope: Deſcriptions and Figures of both of which I have ſince given in a Book intituled, *The Microſcope made eaſy.* Edit. 2d. *Lond.* 1743. 8o.

I meaſured the focal Diſtances, and magnifying Powers, of the Six Glaſſes, and found them to be as follows:

## *A* Table *of the Six Magnifiers belonging to Mr.* Folkes's *Microſcope, calculated by an Inch Scale divided into an hundred Parts, with a Computation of their Powers, to an Eye that ſees Objects at Eight Inches.*

| Glaſſes. | Diſtance of the Focus. | Magnifies the Diameter. | Magnifies the Superficies. |
|---|---|---|---|
| 1ſt. | . . $\frac{1}{50}$ of an Inch. | . . 400. | . . 160,000. |
| 2d. | . . $\frac{1}{20}$ . . . . . . | 160. | . . 25,600. |
| 3d. | . . $\frac{8}{100}$ . . . . . . | 100. | . . 10,000. |
| 4th. | . . $\frac{18}{100}$ . . . . | 44. | . . 1,936. |
| 5th. | . . $\frac{3}{10}$ . . . . . . | 26. | . . . 676. |
| 6th. | . . $\frac{1}{2}$ . . . . . . | 16. | . . . 256. |

The above Calculation ſhews, that Mr. *Folkes*'s Firſt Glaſs magnifies the Superficies of an Object Six times as much as the greateſt Magnifier of Mr. *Leeuwenhoek:* And that the *Animalcula* (a Million whereof, he ſays, ſcarce equalled the Bigneſs of a Grain of Sand) would, if viewed with this Magnifier, appear as large as Sixteen Grains of Sand do to the naked Eye. And I cannot ſuppoſe but Mr. *Leeuwenhoek* had Glaſſes to magnify even more than this, though they are not come to us. For I cannot otherwiſe conceive, how he could obſerve the *Animalcules* in the *Semen maſculinum* of a *Flea*, and of a *Gnat*, as we find he did, (Vol. IV. pag. 21, 22.) or aſſert, as he does in the ſtrongeſt Terms, (pag. 23.) that he could ſee the minuteſt Sort of *Animalcules* in *Pepper-water*, with his Glaſſes, as plainly as he could Swarms of *Flies*, or *Gnats* hovering in the Air with his naked Eye, though they were more than Ten Millions of Times leſs than a Grain of Sand.—And leſt this ſhould be imagined only a random Gueſs, he gives immediately a regular Arithmetical Calculation to prove his Computation right. But I believe we muſt all be ſenſible, that no Glaſſes in this Cabinet are able to render ſuch minute Objects diſtinguiſhable.

I am deſirous to do all poſſible Juſtice to theſe Microſcopes, by acknowledging their Excellence, as far as their magnifying Power extends: But I ſhould do Wrong to Mr. *Leeuwenhoek*, ſhould I ſuffer the World to believe theſe were his greateſt Magnifiers; ſince whoever hereafter ſhould examine them with that Imagination, would be apt to entertain a bad Opinion of his Veracity.

Experience teaches, that Globules of Glaſs extremely minute, though they magnify prodigiouſly, are ſeldom able to ſhew Objects ſufficiently diſtinct, and therefore are very apt to lead People into Errors: Which certainly was a good Reaſon for Mr. *Leeuwenhoek*'s rejecting them: But a ground convex *Lens*, though much ſmaller than any of his before us, if rightly applied, will ſhew exceedingly minute Objects magnified to a ſurpriſing Degree, and with ſufficient Light and Clearneſs, as Mr. *Folkes*'s Firſt Glaſs witneſſes.

I hope I ſhall not be imagined to intend any Diſreſpect to this famous Man, if I ſuppoſe, that our preſent Microſcopes are much more uſeful and convenient than theſe of his. Let him always be remembered with the higheſt Honour, for the wonderful Diſcoveries he made, and the Microſcopes he has left us, which are indeed extraordinary, when conſidered as the Firſt almoſt of their Kind: Let us reverence him as our great Maſter in this Art. But the World ſince muſt have been ſtrangely ſtupid, if it could have improved nothing, where there was room for ſo much Improvement. I do not mean as to the Glaſſes (for the Goodneſs of theſe before us, gives juſt Reaſon to believe he might have others as excellent as can perhaps be ever made); but as to the Structure of the Inſtrument they are ſet in, and the Manner of applying Objects to them. And I fanſy moſt People will allow, that herein great Improvements have been made: And it is with Pleaſure I find, that a large Share of the Credit belongs to our own Countrymen.

One thing alone (which, when ſlightly conſidered, may appear but trifling) has conduced greatly to theſe Improvements; and that is, the making uſe of fine tranſparent *Muſcovy Talc* or *Iſinglaſs*, placed in Sliders, to incloſe Objects in. Had Mr. *Leeuwenhoek* known this Way, it would have ſaved him a vaſt deal of Expence and Trouble: For then, we may reaſonably ſuppoſe, inſtead of making an intire and ſeparate Microſcope for every Object he was deſirous to keep by him in Readineſs to ſhew his Friends, he would probably have ſecured his Objects in Sliders, as we at preſent do, and have contrived ſome ſuch Means as ours, of ſcrewing his ſeveral Glaſſes of different magnifying Powers, occaſionally, to one and the ſame Inſtrument, and of applying his Sliders to which of them he judged beſt.——A few good Glaſſes, gradually magnifying one more than other, would, by ſuch a Method, have anſwered all the

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Purpoſes of his great Number, and his Objects would have been preſerved in a much better Manner.

I ſhall forbear troubling you with the different Microſcopes invented by *Wilſon*, *Marſhal*, *Culpeper*, *Scarlet*, and others, (though all deſerving Praiſe) ſince you are already ſo well acquainted with them: But Two extraordinary Improvements have appeared within theſe Two Years, which I beg Leave to lay before you, as I think it has not been yet done.—I mean, the Solar or *Camera Obſcura* Microſcope, and the Microſcope for opake Objects. Both theſe Inventions we are obliged for to the ingenious Dr. *Liberkhun*, who, when he was in *England* laſt Winter was Twelvemonth, ſhewed an Apparatus of his own making, for each of theſe Purpoſes, to ſeveral Gentlemen of this SOCIETY, as well as to ſome Opticians, amongſt whom Mr. *Cuff*, in *Fleetſtreet*, has taken great Pains to improve and bring them to Perfection; and therefore the Apparatus prepared by him is what I am about to deſcribe.

This Solar Microſcope is compoſed of a Tube, a Looking-glaſs, a convex Lens, and a Microſcope. The Tube is of Braſs, near Two Inches in Diameter, fixed in a circular Collar of *Mahogany*, which, turning round at Pleaſure, in a ſquare Frame, may be adjuſted eaſily to a Hole in the Shutter of a Window, in ſuch a Manner, that no Light can paſs into the Room but through the aforeſaid Tube. Faſtened to the Frame by Hinges, on the Side that goes without the Window, is a Looking-glaſs, which, by means of a jointed braſs Wire coming through the Frame, may be moved either vertically or horizontally, to throw the Sun's Rays through the braſs Tube into the darkened

Room. The End of the braſs Tube without the Shutter has a convex Lens, to collect the Rays, and bring them to a Focus; and on the End within the Room, *Wilſon's* Pocket-Microſcope is ſcrewed, with the Object to be examined applied to it in a Slider. The Sun's Rays being directed by the Looking-glaſs through the Tube upon the Object, the Image or Picture of the Object is thrown diſtinctly and beautifully upon a Screen of white Paper, and may be magnified beyond the Imagination of thoſe who have not ſeen it.—I aſſiſted lately in making ſome Experiments with Dr. *Alexander Stuart*, by means of this Inſtrument, and a particular Apparatus contrived, by him, for viewing the Circulation of the Blood in *Frogs*, *Mice*, &c. and had the Pleaſure of beholding the Veins and Arteries in the Meſentery of a *Frog* magnified to near Two Inches Diameter, with the Globules of the Blood rolling through them as large almoſt as *Pepper-corns*. We examined alſo the Structure of the Muſcles of the *Abdomen*, which were prodigiouſly magnified, and exhibited a moſt delightful Picture. But, as the Doctor intends himſelf to communicate to you an Account of theſe Experiments, I will not anticipate your Pleaſure.

The Microſcope for opake Objects remedies the Inconvenience of having the dark Side of an Object next the Eye: For by means of a concave Speculum of Silver, highly poliſhed, in whoſe Centre a magnifying Lens is placed, the Object is ſo ſtrongly illuminated, that it may be examined with all imaginable Eaſe and Pleaſure.—A convenient Apparatus of this kind, with Four different Specula, and Magnifiers of different Powers, has lately been brought to Perfection by Mr. *Cuff*; whoſe Copper-plate and Deſcription of it, as it will ſave much Trouble, and make me better underſtood, I take the Liberty, at his Deſire, to preſent herewith, together with his printed Account of the Solar Microſcope, the Pocket Microſcope, and the Microſcope before ſpoken of, with a Scroll, Pedeſtal, and Speculum, of which there are alſo Copper Plates. Theſe, with the large double reflecting Microſcope, are, I think, the chief, if not the only uſeful Sorts now made in *England*.

I muſt not omit taking notice, that Mr. *Leeuwenhoek* ſays, (in his Second Volume, Part II. pag. 93.) that ſometimes, to throw a greater Light upon his Objects, he uſed a ſmall convex Metal Speculum. How he applied it, I will not pretend to gueſs; but it is highly probable our double reflecting Microſcope may be owing to this Hint. I muſt alſo obſerve farther, that in the Fourth Volume of his Works, pag. 182. after deſcribing his Apparatus for viewing *Eels* in glaſs Tubes, Mr. *Leeuwenhoek* adds, that he had another Inſtrument, whereto he ſcrewed a Microſcope ſet in Braſs; upon which Microſcope, he tells us, he faſtened a little Diſh (of Braſs alſo, I ſuppoſe), that his Eye might be thereby aſſiſted to ſee Objects better: For he ſays, he had filed the Braſs which was round his Microſcope, as bright as he could, that the Light, while he was viewing Objects, might be reflected from it as much as poſſible. This Microſcope, with its Diſh, (which I give an exact Copy of from the Picture in his Works) ſeems ſo like our opake Microſcope with its ſilver Speculum, that, after conſidering his own Words, I ſubmit to your better Judgment, whether he is not properly the Inventor of it. His Words are theſe,——" Supra "hoc Microſcopium Catillum ferruminavi, ut oculus "objecta tanto melius videret: nam cuprum circa "Microſcopium, quantum pote, lima abraſeram, ut "Lumen in conſpicienda objecta, quantum pote, "irradiaret."

*See the Figure of this Apparatus in* TAB. IV. *at* G.

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## X. *An Inquiry into the Cauſes of a* dry *and* wet Summer. *By an* anonymous *Hand.*

THE wet Weather which we had in *March* 1734. (the Year beginning with *January*) ſet me on conſidering what might be the Cauſes of it. The Wind was then, generally, South-weſt, the Weather rainy. Sometimes it veered to South-eaſt, which, commonly, brought much Rain: But the Wind ſeldom ſtood at that Point 24 Hours, before it returned to South-weſt again. A ſtrong Gale at South-weſt, with Rain, would be ſucceeded by as ſtrong at North-weſt, ſtill raining; but if the North-weſt continued 24 Hours, it cleared the Sky. The Summer following was cold and wet; the Wind on the ſame Points. The preceding Winter was mild, and eſpecially *December*, in which Month, from the 10th incluſive, the Wind blew, generally, South-weſt, ſometimes ſtrong, attended with much Rain. At the End of *December*, the Birds ſang, and the Graſs did grow as at other Years in the Spring.

The Winter of 1734. was as mild as that of 1733. the Birds as joyful, and the Graſs as green at the End of *December*, the ſame Winds ſtill prevailing; but the South-weſt was more ſtormy. On *December* 29th, there blew a Storm, firſt from South-weſt, and then from North-weſt: But the Storm of *January* the 8th was much ſtronger, which blew on the ſame Points. The Summer of 1735. was colder, and wetter than the preceding Summer.

This put me on recollecting what ſort of Winter went before a dry Summer. In the Year 1731. the Summer was remarkably dry. I had not begun to keep a Journal of the Weather in the Year 1730. But I took ſo much Notice of the unuſual Cold in *April* 1731. that I made the following Remarks. *April* 1. begins with peircing cold Winds at North-eaſt, black Clouds, ſtormy, very dry. 4th, 5th, ſome Wind, Ice. 6th, 7th, 8th, 9th, ſame Wind. 9th, Snow. 10th, The Harbour frozen over. If my Memory doth not fail me very much, it was in the Winter of the Year 1730. or the Beginning of 1731. that a *Horſe* was frozen to Death in *Moſcow*, as he ſtood in the Street.

From hence I conclude, that a froſty Winter produces a dry Summer; and a mild Winter a wet Summer. I am ſenſible, that theſe Concluſions are drawn from ſhort and imperfect Obſervations: But, ſuppoſing them to be true, I would be glad to know why theſe things are ſo.

I find from theſe and ſome other Obſervations, which I have caſually made, that the Weather depends very much on the Wind. I ſhall therefore begin with inquiring what is the Cauſe of Winds, and then proceed to find out, as well as I can, why the Wind doth influence the Weather.

Wind is a Stream of Air; Air an unmixed Fluid encompaſſing our Globe, with a Shell of at leaſt 60 Miles thick. Every Particle of Air gravitates equally towards the Centre of the Earth. Air is capable of being compreſſed and expanded: The more Air is compreſſed, the heavier it is; the more it is expanded, the lighter. Cold and Heat, whatever they be, or however they act, produce theſe contrary Effects in the Air: That is, Cold doth compreſs the Air, and Heat expands it: Therefore Cold and Heat, in different Parts of the Air, will make it flow: For Cold making the Air heavy, and Heat making it light, the lighter muſt, of courſe, give Way to the heavier; as, in a Balance, a greater Weight makes a ſmaller riſe. We daily ſee a Proof of this in a Stove.

The Sea and Land-breezes, and the Trade-wind, owe their Original to theſe Cauſes. The Sea-breeze, when regular, begins at Nine o'Clock in the Morning, approaches the Shore gently, at firſt; increaſes till Twelve; retains its full Strength till Three; then gradually decreaſes till Five, when it dies away. At Six in the Evening the Land-breeze begins, and continues till Eight next Morning: The Interval between theſe Two Breezes, at Morning and Evening, are the hotteſt Parts of the Day. It is ſaid, that theſe Winds vary in their Periods; which not being to my Purpoſe, I take no Notice of.

The way of accounting for this Viciſſitude of Sea and Land-wind, is thus: The Sun, as it aſcends, ſheds its Heat equally on the Land and Sea; but the Earth receives the Heat ſooner than the Water, or elſe reflects it ſtronger. For one or both of theſe Reaſons, the Air that hangs over the Land, is heated more than the Sea-air, it becomes thereby more rarefied, and conſequently lighter; and therefore the Sea-air, with its ſuperior Weight, flows in upon it every Way. The Intervals between are owing to the Air of both Places being in an equal Degree of Heat, and conſequently of equal Weight.

The Trade-wind never varies, which is thus accounted for: The Air juſt under the Sun is the hotteſt: The cold Air preſſeth upon the hot, as the hot Air follows the Sun; and therefore it makes a perpetual Flow of Wind between the Tropics from *Africa* to *America*, and from thence to the *Eaſt-Indies*.

With regard to the Wind influencing the Weather; I find that though Air be an unmixed Fluid, yet it is capable of receiving many Vapours, which float in it, as we ſee other Bodies float in Water. Sometimes the Vapour aſcends, and ſometimes it falls to the Ground. All which I take to be effected by Heat and Cold in this Manner: Heat ſeparates Water into ſmall Particles, and the incorporated Air, rarefied by the ſame Heat, blows up thoſe Particles into Bubbles; by which means the ſwoln Vapour becoming ſpecifically lighter than a like Space of ambient Air, aſcends, ſwift, at firſt, (which affords a pleaſant Sight in a warm Summer's Day) and then gradually ſlower, till it gets up to that Part of the Air which is of equal Lightneſs with itſelf; and there it remains, as long as the Air continues in the ſame State: But whenever the Air cools, in which theſe watery Bladders float, the Cold contracts the Bladder, which becoming thereby ſpecifically heavier than the Air, down it falls in Dew, or Rain. A common

Alembic ſufficiently ſhews the Operation of Heat and Cold on the aſcending and deſcending Vapour.

Thus in a calm Evening, when there is no Wind to waft the Air, as the Heat of the Sun declines, the Cold arreſts ſome few of the laſt aſcending Vapours, and, by its own Force, without any other Change in the State of the Air, compels them to return, in Dew, to the very Spot from whence they aroſe; whilſt their Brethren eſcape, who go out of the Reach of the Cold a little before the Approach of Night.

Since therefore the ſame Air, in different States of Heat and Cold, affects Vapour in this Manner, it thence follows, that Vapour, wafted from Air of one Temperament to another, muſt be affected in the ſame Manner alſo: So that Vapour, carried from a colder to a warmer Air, will aſcend; and, on the contrary, Vapour carried from a warmer to a colder Air, will deſcend.

Now if Cold condenſes the Air, and thereby makes it preſs upon the warmer; and if Vapour, carried by a Stream of Air from a colder to a warmer Region, aſcends; we have the Reaſon why the North-eaſt blows, and why it blows dry.

Let us fix upon ſome Spot in the Continent of *North-Europe*, whence this Wind comes to us: Suppoſe *Archangel*, which lies on our North-eaſt Point, and is in 65 Degrees Northern Latitude: When the Froſt is intenſe, the incumbent Air there muſt needs be very heavy; that Air will preſs every Way: *Quà data porta, ruit.* Let us conſider which Way this condenſed Air can burſt out from thence: It cannot go to the North, where the Cold is greater;

nor

nor to the Eaſt, for the Air over the large Continent of *Tartary* is at leaſt of equal Coldneſs with itſelf. I make no doubt but they complain at *Archangel*, in their Turn, of cold North and North eaſt, and even Eaſt Winds, as much as we do here. The great Continent to their South muſt be ſo cold as to make a ſtrong Reſiſtance: To the Weſt, the Air might find a free Paſſage over the Ocean, were not the Colds of *North-America* too near. The main Outlet is between both, towards the *Atlantic Ocean*: The warm Air over which being able, of itſelf, to make but a feeble Reſiſtance, yields to the ſuperior Force; the Conqueror eagerly purſues his Victory, and we, happening to lie directly in the Way, feel then a cold dry North-eaſt Wind: This is the Wind that brings us Froſt in the Winter. When the Winter is ſevere, it continues to blow all the Spring, and its Influence reaches to the End of the Summer.

This, I think, ſufficiently proves, that Air, flowing from a cold to a warmer Quarter, will blow dry: But, like a willing Witneſs, it proves too much; for, if Wind proceeds only from cold Air preſſing upon hot, and if Heat makes the Vapour aſcend, it follows from thence, that Wind can never bring Rain; whereas we find the contrary by ſad Experience; the South-weſt Wind hath ruled theſe Two Years, and ſtill doth rule.

How can this be accounted for, upon the Principles commonly received? That Vapour, wafted from a warmer to a colder Region of Air, ſhould precipitate, is what I have already ſhewn. But the Queſtion is, which I have not as yet ſeen anſwered, Why does the South-weſt blow? What is the Cauſe why a Stream of Air ſhould be carried, for ſo long a Time, and with ſo great Violence, as we have often felt, from a warmer to a colder, from a rarer to a denſer, from a lighter to a heavier Quarter? To the North-eaſt of us lies the Continent of *North-Europe*, great Part of which is, in the Winter, deprived of the Sun's Heat, and conſequently very cold; on the other Side, to the South-weſt, lies the vaſt *Atlantic Ocean*. We find by Experience, that the Sea-ſhore is warmer than the Inland; that the Sea is warmer than the Shore; and that the Ocean is ſtill warmer than the Sea. Beſides, the more you go from hence towards the South, the nearer you go to the Sun; and the more North, the farther from it: This muſt make the South-weſtern Ocean much warmer than the Continent, that lies at an equal Diſtance, on the oppoſite Point. From this very warm Place, the Wind blows to a Place much colder; and yet there muſt be a natural Cauſe of all this apparent Contradiction to the Laws of Nature: Whether we can find it out or not, I ſhall attempt it at well as I can.

It will be in vain to ſeek for the Cauſe of this Wind in this Ocean itſelf, or in the Air over it, influenced only by the Sun, and the Surface of the Sea. But there may be *Tornados* in thoſe Seas: Our Seamen often meet them between the Tropics, ſeldom, as I am told, in the Ocean I am now ſpeaking of, which is to the North of the Northern Tropic But were they more frequent and violent than they really are, yet they are not laſting, and therefore cannot produce a long ſteady Courſe of South-weſt Winds with us.

My Conjecture is, that our South-weſt Wind is no other than an Eddy of the Trade-wind, reflected from *America* to us. Though we cannot ſee the Eddy of Air, as we do that of Water; yet we muſt be otherwiſe very ſenſible, that it makes a ſtrong Recoil, when it meets with lofty Buildings, Woods, Hills, *&c.* The more elaſtic any Body is, it rebounds with the more Agility; and the Experiments that have frequently been made, ſufficiently ſhew the vaſt Elaſticity of the Air. There can, I think, be no Difficulty in conceiving, that there may be an Eddy of Wind from that Part of *America* which lies under the Equinoctial Line, even to us, provided there be a ſufficient impelling Force, and due Reſiſtance, and a proper Direction.

The impelling Force is a ſteady briſk Stream of Air, flowing perpetually from *Africa* to *America*: The Strength of this Wind may be in ſome meaſure judged of, from what Sailors obſerve, and expreſs in their Language, thus: It commonly blows a good Top-ſail Gale, as we ſail large; and if we were to ſail on a Wind, our lower Sails would be enough. I am ſenſible of what every Map ſhews us now, that the Trade-wind does not blow exactly from Eaſt to Weſt: But though the Arrows are placed as if ſhot obliquely towards the Equinoctial, or rather towards a Line parallel to it, and diſtant from it between 4 and 12 Degrees North Latitude, yet they are all pointed Weſtward; and that, I preſume, will be as much to the Purpoſe I am upon, as if the whole Stream went due Weſt.

In order to gueſs at the Momentum of this repelling Force, we ſhould conſider the Breadth and

Height of that Part of the Trade-wind, which I ſuppoſe to be turned this Way.

With regard to the Breadth, I read in *Dampier*, that they meet the Trade-wind at about 30 Degrees on this Side the Line; as many Degrees on the other Side will make the Whole extend to 60 Degrees broad. Methinks I do not want ſuch a Breadth, nor indeed can I fairly expect it. For ſo much of this Wind as blows to the South of the moſt Eaſtern Point of *South America*, which, I think, is called *Cape St. Auguſtin*, ſhould turn off Southward; the reſt, which blows to the North of that *Cape*, I may lay Claim to. This *Cape* is in about 8 Degrees South Latitude, ſo that I may demand a Breadth of 38 Degrees; but I will make an Abatement: For though the Trade-wind, to the North of the Line, be ſometimes 30 Degrees broad, yet ſometimes it is not above 24 Degrees; which Variation depends, as I ſuppoſe, on the Sun's Place in the *Zodiac*: So that it is narroweſt in the Winter, and wideſt in the Summer. Taking it then at the narroweſt, when the Sun is in the Winter Solſtice, we ſhall have a Breadth of 32 Degrees: But I allow 2 Degrees, to make Amends for the ſlack Wind, to the North of the Tropic of *Cancer*, and for the Calms near the Equator; and inſiſt on 30 Degrees only, for the Breadth of that Trade-wind, which is to be reflected back to us.

How high ſoever that Column of Air be, which is carried through this wide Space, no more of it can affect us, than what is repelled by the Hills it ſtrikes againſt, and by the cold Air which hangs over them.

I take theſe high Lands, and their incumbent Air, to be a Reſiſtance ſufficient to repel the Trade-wind:

The Land muſt needs be ſo to its Height; and the Air over it, being many Degrees colder than the Trade-wind, will make a Reſiſtance in proportion to its ſuperior Weight. How high this Reſiſtance may be, I cannot pretend to determine: If I require no more than 3 Miles from the Surface of the Sea to the Top of the higheſt Ridge of Hills, within the Tract I am now ſpeaking of, and to the cold Air above them, I think I make but a modeſt Demand. Here, then, we have a Gale of Wind of the Breadth of 30 Degrees, 3 Miles high, carried with a great Velocity from *Africa* to *America*, a Momentum more than ſufficient to drive the Air from *America* to us, if there be but a proper Direction.

Were the whole Stream of the Trade-wind like a Mathematical Line, mere Length, without Breadth, and were this ſtrait Line to ſtrike on a ſmooth Surface of a given Inclination, we could know its Direction exactly. For it is a Rule in Geometry, that the Angle of Reflexion is equal to the Angle of Incidence. Suppoſe, for Example, that the Line of Trade-wind blew juſt South-eaſt, as it is ſaid to do, South of the Equator; that the Surface it ſtruck againſt ran exactly from South to North, as the Hills of *Peru* do; and that the Point of Incidence were under the Equator; in this Caſe the Angle of Incidence will be half a Right Angle, or an Angle of 45 Degrees, and conſequently the Angle of Reflexion will be 45 Degrees: Now, as theſe Degrees, when the reflected Line ſhall have run 90 Degrees in Length, will be equal to Degrees of a great Circle, and as we are about 90 Degrees Eaſt of this ſuppoſed Place of Contact, therefore this reflected Line will, in our Longitude, reach to 45 Degrees of North Latitude, which is about *Bordeaux*. If we ſhould ſuppoſe the whole Breadth of the Trade-wind to conſiſt of an infinite Number of parallel Lines, falling on a Surface of the ſame Inclination, then the reflected Lines will be all parallel, and conſequently the Angles will be all equal; but they will reach wider, according to the Diſtance of one Point of Contact from the other; ſo that if that Line, which fell on the ſuppoſed Surface under the Equator, be reflected to 45 Degrees North Latitude, that which fell on the ſame Surface to the North of the Equator, ſuppoſe in 23 Degrees Latitude, will reach to 68 Degrees North Latitude; which is to the Northward of the *Orcades*, and almoſt to the North Cape of *Norway*. Or if we ſuppoſe the Trade-wind to the North of the Equator, to flow directly North-eaſt, as it is alſo ſaid to do, and to ſtrike againſt a Surface inclining from South-eaſt to North-weſt, which is pretty near the Bearing of the *Iſthmus* that joins *North* and *South America*; in both theſe Caſes the Reflexion will be towards the North-eaſt.

But there is no depending on this way of calculating: Not that God does not act according to the exacteſt Rules of Geometry, in the Motion of the Winds, as well as in all other Parts of the Creation: But we do not know, at leaſt I am far from pretending to know, all the infinite Variety of Reverberations that the Wind muſt have, from the uneven Surfaces it ſtrikes againſt, between Cape *St. Auguſtin* and the Bottom of the Gulph of *Mexico*. I make no doubt but that different Parts of this Air are reflected a Thouſand different Ways; and yet that the

Whole afterwards unite, or the far greater Part, and flow this Way. I find myſelf under a Neceſſity of ſuppoſing what I cannot demonſtrate Mathematically, ſince I can aſſign no other Cauſe why the South-weſt Wind blows ſo long with us.

But there are ſome other Facts which ſtrongly ſupport my Hypotheſis; *viz.* Currents of the Sea, and the Wind in the *Atlantic* Ocean, to the Northward of the Trade-wind.

With regard to the Currents, *Dampier* tells us, it is generally obſerved by Seamen, that, in all Places where the Trade-wind blows, the Current moves the ſame Way with the Wind; and that though it be perceived moſt near the Shore, yet it makes no ſenſible Riſing in the Water, as the Tides do. He ſays, there is always a ſtrong Current ſetting from Cape *St. Auguſtin* Weſtward, occaſioned, as he remarks, by the South-eaſt Trade-wind driving the Surface ſlanting on the Coaſt of *Braſil*; which, being there ſtopped by the Land, bends its Courſe Northerly, towards Cape *St. Auguſtin*; and, after it has doubled that Promontory, it falls away towards the *Weſt-Indies*, down along the Coaſt Weſtward, till it comes to Cape *Gratia de Dios*; from thence North-weſt towards Cape *Catoch* in *Jucatan*, thence to the Northward between *Jucatan* and *Cuba*. He ſays, that in the Chanel, between *Jucatan* and *Cuba*, he has found the Currents extraordinary ſtrong; that it is probable, that the Current which ſets to Leeward, on all the Coaſt from Cape *St. Auguſtin* to Cape *Catoch*, never enters the Bay of *Mexico*, but bends ſtill to the Northward, till it is checked by the *Florida* Shore; and then wheels about to the Eaſt, till it comes near the Gulph's Mouth, and paſſes with great Strength through the Gulph of *Florida*, which is the moſt remarkable Gulph in the World for its Currents, becauſe it always ſets very ſtrong to the North.

Thus far this Pilot: And, if too great a Fondneſs for my own Conjecture does not prejudice me very much, I may venture to ſay, that theſe Obſervations ſtrongly confirm it. He takes notice of the firſt Current which the Trade-wind makes near the Shore at Cape *St. Auguſtin*, where it is ſtrong; thence he traces it from one Cape to another, as it winds about by different Directions, yet ſtill gathering Strength at every Turning: It is extraordinary ſtrong between *Jucatan* and *Cuba*, but ſtrongeſt at the End of its Courſe in the Gulph of *Florida*. This Acquiſition of Strength upon a new Direction, is contrary to the Laws of Motion; therefore it muſt be owing to a freſh Supply, which the reſt of the Current, cauſed by the Trade-wind, gives it, till at length the whole Power, joined together, ruſhes out into the *Atlantic* Ocean.

Let us then ſuppoſe the Wind, which drives this Water before it, to follow it much in the ſame Courſe; and that, inſtead of ſtriking againſt one plain Surface, with ſuch an Inclination as would direct it to us, it ſtrikes againſt a Million, yet ſtill bending this Way: Let this natural Suppoſition be admitted, and we have the very Thing ſought for, *viz.* a proper Direction.

The other Fact is this: That when our Ships return from the *Weſt-Indies* through the Gulph of *Florida*, and are got into the wide Ocean, they have a regular

Wind at South-weſt, or near that Point, which ſometimes attends them to their very Port. This Wind cannot have its Riſe in that Ocean, nor can it come from any Continent that lies to the North, or even Weſt of it; therefore I conclude, that it muſt be an Eddy of the Trade-wind.

But to all this it may be objected, that the Sea-current ſets out of the Gulph of *Florida* towards the North; whereas, I ſay, the Wind comes towards the North-eaſt. Sailors, it ſeems, take no farther Notice of theſe Currents, than while they are near Head-lands, where they are ſtrongeſt, and affect their Navigation moſt. But there ſeems to me to be a Neceſſity of the Continuance of this Current much farther than the Gulph of *Florida*, and of its taking new Directions from the North towards the North-eaſt, and thence even towards the South, before it be quite ſpent. For it muſt be a vaſt Quantity of Water that is driven by the whole Breadth of the Trade-wind, from *Africa* to the Shores of *America*; the far greater Part of which, as *Dampier* ſuppoſes, doth flow by the Promontory of Cape *St. Auguſtin* Weſtward. This great Flux of Water has found a Paſſage out towards the North, between *Florida* and *Cuba*; which is the Reaſon, that, notwithſtanding the Current ſets Weſtward, the Sea in the *Weſt Indies* never riſes. Here we ſee, that the Middle Ocean is at a great and conſtant Expence of Water; it muſt therefore want a Supply, and no Supply ſo natural, as for it to have its own Water again; which, after it hath paſſed the Gulph of *Florida*, meets with one Check ſtill after another, till it returns to the Place from whence it came.

For the ſame Reaſon we may ſuppoſe, that though the Eddy of the Trade-wind ſhould be reflected due North, from the Land it firſt ſtrikes againſt; or even though it ſhould undergo as many Turnings as the Surface of the Sea it drives before it; yet it may take a new Direction in the Ocean, cauſed by the Winds that blow from the Continent of *North America*.

Another Objection may be made againſt the South-weſt Wind being an Eddy of the Trade-wind, from what I myſelf have advanced, *viz.* that Cold is the Cauſe of Wind: That the *Atlantic* Ocean is too warm to produce this Wind; and yet that it comes from the Trade-wind, which blows between the Tropics, a Place much warmer: So that, according to this, here is a very warm Wind making its Way againſt the Cold of the North.

That Wind will blow from a warmer to a colder Quarter, is confirmed not only from the South-weſt raging with us in Winter, which muſt be confeſſed to come from a much warmer Climate, whatever Cauſe it be owing to; but from the almoſt daily Obſervation of thoſe who live in the Country, and will look a little about them. Whoever is within the Sight of Hills, and there are few Places where there are not ſome in View, will find, if he takes the leaſt Notice, that it rains in the Hills before it rains in the Vales: What can be the Cauſe of this Rain? Nothing, doubtleſs, but a Wind blowing from the Vales towards the Hills; that is, from a warmer to a colder Region, where the Vapour, which is brought thither, falls. Suppoſe the Air over the Hills be cold in 20 Degrees, and the Air over the Vales but in 10 Degrees, 10 cannot outweigh 20;

but, if it gets an additional Force of 30, it will then be double the Strength of 20; and, conſequently, blow from a warmer to a colder Quarter.

The *Momentum* of every Thing that moves, is made up of Two Powers, Weight and Velocity, multiplied by one another. This is fully ſhewn in the Butcher's Stiliard, which, with a Weight of 5 Pound, will weigh 100 Pound, by placing the 5 Pound Weight 20 times farther from the Centre, than the Thing to be weighed is placed: For 5 Pound the Weight multiplied by 20, the Velocity is equal to 100 Pound. Suppoſing then that the Cold to the North-eaſt of us be 100, and the Cold which drives the Trade-wind, only 5; that is, that the Cold of the one Place be 20 times greater than the Cold of the other: But ſuppoſing the Air 5 Degrees cold, to move 20 times faſter than that which is 100 Degrees; upon this Suppoſition the *Momentum* will be equal: And ſince they move in direct Oppoſition to one another, they will meet exactly half way, which I take to be ſometimes near the Caſe. But if the Northern Power ſhould loſe one Half of its Weight, *i. e.* be milder, by one Half, one Winter than it is another, the other Power ſtill continuing the ſame, then the South-weſt will blow one Half farther.

I am aware of but one Objection more, which is, that in the Gulph of *Florida*, through which I ſuppoſe the Trade-wind to flow towards us, there are variable Winds, which muſt interrupt this Stream, if there be any; ſince the ſame Air cannot flow different Ways at the ſame time.

It is no new thing to have variable Winds near the Land, even in the midſt of the Way of the Trade-wind. The Weſterly Winds, which, as *Dampier* ſay blow on the Coaſt, between Cape *Gratia de Dio* and Cape *La Vela*, are a Proof of it. The commo Trade-wind on this Coaſt is between North-eaſt an Eaſt; but from *October* till *March*, and chiefly i *December* and *January*, the Winds blow Weſt; an yet when they are longeſt and ſtrongeſt on the Coaſ the Eaſterly Trade-wind blows off at Sea, as at othe times. Near Cape *La Vela*, the true Trade blow within 8 or 10 Leagues off the Shore, when th Weſterly Winds blow on the Coaſt. This ſhew that theſe Land-winds reach but a little Way, an therefore can have but a ſmall, if any, Influence o the main Stream of the Trade-wind.

In ſmaller Navigations here in *Europe*, they fin the Wind out at Sea different from what it is nea the Shore, and eſpecially near Head-lands, where i generally blows hardeſt, and which helped to mak the Navigation of the Antients, in the *Mediterranean* ſo tedious and dangerous. Theſe variable Coaſ winds may be owing to great Snows, or Rains tha fall upon Highlands, when there is none, or little, a Sea, or to ſome Storms of Thunder that burſt ove them, or to their natural Coldneſs, or even to th Repercuſſion of the Air. I take the variable Win they meet on the Coaſt of *Florida*, to be owing t the like Cauſes, which have their Influence but little Way.

But it may be ſaid, that theſe variable Winds o the Coaſt of *Florida* are found ſo near the Trad wind, that there is no Room between them for t Eddy of the Trade-wind, I am ſpeaking of, to pa out. It may be Fact, for aught I know: I will ſu

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poſe it to be Fact. But I deſire the Objector to conſider, that, when he is ſailing, he is on the Top of the Water, and at the Bottom of the Air; he perceives the Current of Water run very faſt at Top, but does not know how it runs at the Bottom. It is very certain, that there are Under currents in Water: In Rivers that ebb and flow, it is perceived every Tide; for the Current will run up after it hath begun to ebb. By Experiments that have been made, it appears, that in ſome Places, where the Current on the Surface is very ſtrong, the Under-current, running quite the contrary Way, ſhall be much ſtronger, and carry away a Boat againſt the Force of the upper Current.

And why may there not be contrary Currents in the Air? An Element much more ſubtile than Water, and therefore capable of being put into a greater Variety of Motions. The Sailor concerns himſelf no farther with the Wind, than as it fills his Sails, the Height of which can bear but a ſmall Proportion with that Column of Air I am now ſpeaking of. The Land-breezes about Iſlands, in the Torrid Zone, ſhew different Currents in the Air. For, in the Night, the Wind ſhall blow from the Centre of the Iſland, every Way, into the Sea, and even in direct Oppoſition to the Trade-wind, and yet give no Interruption to the Progreſs of it, except juſt in that little Spot, and for a ſmall Height too; which is evident from hence, becauſe in ſailing to the Weſtward of *Barbadoes*, ſuppoſe, or *Jamaica*, without the Reach of the Land-breeze, you feel no Interruption in the Strength of the Trade-wind, by Night as well as by Day.

I, who am one of no great Obſervation, have frequently ſeen different Currents in the Air, at the ſame Time, and in the ſame Quarter, under one another. For Example: When the under Current has been Eaſt, the upper Current has been South-weſt, and the middle South-eaſt. I ſhall appear ridiculous, if I ſay I ſee the Wind; the Vulgar think, that Swine only are endowed with that Quickneſs of Sight. I do not ſay, that I can ſee the Wind; but I have often ſeen Clouds, Weather-cocks, Smoke, and ſuch-like Things, that are either carried or turned by the Wind. Smoke and Vanes are ſo near, that they can hardly cauſe any Deception; ſome Clouds may, unleſs properly obſerved: For when there are Two Tire of Clouds, both carried the ſame Way, and with the ſame Velocity, the upper Tire ſhall appear to move directly contrary to the lower; which Deception is owing to the different Angles that Objects of the ſame Magnitude, at different Diſtances, make on the *Retina*.

The way to obſerve the Motion of the Clouds, is by looking at them and a fixed Object at the ſame time, as the Sun and Stars, ſometimes: The beſt ſuperior fixed Object is the Moon in her Quarters, which may be then ſeen by Day-light, without offending the Eye. The fixed Objects below the Clouds are, a Ridge of Hills, lofty Buildings, or, for want of them, a Tree. By obſerving a Cloud with any fixed Object, you will not only ſee on what Point of the Compaſs the Clouds paſs; but you will ſee alſo the Motion of the upper and under Current: By this means you will find, as the Caſe happens, either both Currents going the ſame Way, though with different apparent Velocity; or the upper Current going one Way, and the lower another, and perhaps you will ſee the Smoke going a Third. This ſufficiently ſhews, that there are different Currents in the Air.

From all my little Obſervation I find, that the upper Current generally prevails. For though the under Currents from, ſuppoſe, the Eaſt, or even North-eaſt, be briſk at firſt, and the brisker they are at firſt, the longer they continue; yet they die away by degrees, as their Strength ſpends itſelf; the Air becomes near calm, and then the South-weſt, which before blowed aloft, deſcends to the Earth, and commands the whole Sky.

That the Diſorders of the lower Air do not affect the Stream above, appears alſo from the Trade-wind paſſing over the very Continent, from the Eaſtern to the Weſtern Side of *America*. I make no doubt but the high Hills of *Peru* cauſe a greater Variety of Winds and Weather, than we have here. Their Weſtern Sea ſhews, that the lower Part of the Trade-wind meets with great Obſtructions in paſſing over the Continent. For, as *Dampier* obſerves, you do not meet with the true Trade-wind, till you are got 150 or 200 Leagues from Shore; and then it blows in its uſual manner. If all the Diſturbance that the high Hills of *Peru*, ſaid to be the higheſt in the World, give to the Trade-wind blowing over them, cannot intercept the upper Stream, which, after ſurmounting all thoſe Heights, and the Diſorder that their Cold occaſions, ſtoops down again, till it comes to touch once more the Surface of the Ocean; we may eaſily ſuppoſe, that that Part of the Trade-wind, which is reflected from theſe Hills towards the North-eaſt, may diſengage themſelves, in like manner, from all inferior Obſtructions, and fly over all the little low Diſorders of the *Floridan* Coaſt.

Upon the Whole, then, though I cannot pretend to find out the Angle of Incidence, yet I muſt conclude, that the Trade-wind is reflected in ſuch a manner as to cauſe our South-weſt Wind.

And I conceive, that this new Direction is ſo far from checking its Current, that it the rather increaſes it. For a great Part of the cold Air, that hangs over the Continent it ſtrikes againſt, having no other Vent, flies off with the Eddy, and thereby makes more than Amends for the Stop it gave.

From *America* to the Weſt of *England* this Wind glides over the Ocean, a plain Field, that gives no Oppoſition, and which, with its natural Warmth, encourages the Waft, by making the Air over it more ready to yield to the impelled Force.

Having thus opened a Paſſage for the Trade-wind to flow even to us, with a back Stream, if my Conjecture hath opened it; what I have ſaid may ſerve as a Hint to thoſe who have better Materials, and can make a better Uſe of them: But, admitting that my Conjecture is right, we have the Cauſe why the South-weſt Wind blows with us; and then there can be no great Difficulty in finding out the Reaſon why it brings ſo much Rain.

For this Wind blowing over a warm Ocean, which ſends up many Vapours, by the time it reaches us, comes charged with an infinite Swarm of watery Bladders, which the Cold of this Climate condenſes, and then down they fall in Showers of Rain.

From hence it appears, that the Two great Rulers of the Weather with us are the North-eaſt and South-weſt Winds. Like Two neighbouring potent Monarchs, they are engaged in eternal Wars: Sometimes the one puſhes his Conqueſt with great Rapidity; and ſometimes the vanquiſhed Power not only recovers its loſt Dominions, but carries on the War into his Enemy's Territories with great Succeſs. As we happen to lie near their Frontiers, we feel, by turns, the different Effects of their fierce Contention: Some Years we have a Run of North-eaſt Winds, froſty Winters, and dry Summers; and ſome Years the Reverſe of all this.

But if I have hit upon the true Cauſes of theſe Winds, yet the Queſtion will be, On which Side lies the Redundancy, or Failure, that makes all this irregular Variation? For, between Two Antagoniſts, the Advantage will be the ſame to the Conqueror, whether his Superiority be owing to his own Strength, or the Weakneſs of his Adverſary. I would be glad to find this out, but I doubt that all my little Search will not be able to do it. I will proceed as far as I can.

Let us ſuppoſe, in the firſt Place, the North to be intirely paſſive, and that all the Variation of Cold and Heat is owing wholly to a Defect, or Exceſs, in the South-weſt Wind: So that, when the South-weſt blows, it ſhall be always warm; and, when it ceaſes to blow, it ſhall be ever cold. If this be Fact, then it will follow, that whilſt the South-weſt blows with the ſame ſteady Gale, the Weather ſhall be of the ſame Degree of Heat: But we find it otherwiſe; for the Nights, in a mild Winter, are colder than the

Days, the ſame South-weſt ſtill blowing; therefore Cold, with us, is not wholly owing to a Slackneſs of the South-weſt Winds.

Let us now ſuppoſe the Privation of the Sun's Heat to be the only Cauſe of Cold: The Conſequence will be, that all Places equally diſtant from the Sun, will be equally cold. But it is well known, that, in the ſame Northern Latitude in *Europe*, Cold is greater on the Continent than in Iſlands: Therefore Privation of the Sun's Heat is not the only Cauſe of Cold. The Sun's Abſence, like other negative Cauſes, can amount only to the Removal of an Obſtruction which hindered the efficient Cauſe of Cold, whatever it be, from acting.

Since the larger the Tract of Earth, the greater the Cold, the efficient Cauſe of Cold ſeems to be in the Earth; and yet, when we deſcend a little Way under-ground, not only in Mines, but in ſome Cellars, we find an even Temperament: We muſt therefore confine this efficient Cauſe of Cold to the Earth's Surface.

But if the Earth's Surface be the ſole efficient Cauſe of Cold, ſince the Surface of the Earth ſtill continues the ſame, the Cold ſhould be the ſame on that Surface every Winter; whereas we find it otherwiſe. We muſt, therefore, ſeek for ſome concurrent Cauſe, between whom and the Earth's Surface this Cold is generated; and that, I think, can be no other than what is carried on the Wings of the Wind.

*Dampier* obſerves, that, after a *Tornado* at Land in *Jamaica*, the Land-wind will begin by Four or Three o'Clock in the Afternoon. The Materials of this *Tornado* muſt be carried thither by the Wind; where the *Tornado* burſts, it cools the Air; which makes the Land-breeze begin ſome Hours ſooner than its uſual Courſe.

That the South-weſt Wind, warm as it is, carries with it the Seeds of Cold, is evident from thoſe violent Storms of Thunder, attended with great Rains, and large Hailſtones, ſeveral of which happened this laſt Summer.

The 8th of laſt *September* was a cold Winter's Day at the Place where I dwell. In the Morning, when I awoke, I perceived a great Dew on the Inſide of the Glaſs of my Chamber-window: When I went out, I obſerved the Wind to be North-eaſt, ſtrong, black Clouds, and little Rain early, reſt dry. 9th in the Morning, the Wind was North-eaſt, briſk, dry. I began to think, that the Winter was going to ſet in very ſevere; but I was in a little time undeceived. The Afternoon of the 9th was overcaſt. On the 10th, I ſaw Colts-tails, as the Sailors call them: I take them to be *Virgil's Tenuia lanæ vellera:* Marks of Rain, that ſeldom deceive thoſe who are uſed to obſerve them. On the 11th, the Wind returned again to its old Point of South-weſt, with Rain. Some time after, I did read in the News-papers, that on the 7th a violent Storm fell about *Worceſter*, which is diſtant from hence about 2 Degrees, and bears, nearly, on the North-eaſt Point. Then I found out the Cauſe of that little Winter.

I could mention more Facts of this Kind, but theſe, I believe, are enow to ſatisfy us, that the Seeds of Cold are carried on the Wings of the Wind. It will be needleſs to take notice, that the Wind carries the

Cold back again: Every one who feels his Hands tingle in a froſty Morning, and looks at the Weather-cock, muſt be ſenſible of it.

Since, therefore, a large Surface of Earth to the North of us, aſſiſted only with a Privation of the Sun's Heat, cannot produce Cold to ſo great a Degree, as to affect the Weather with us; and ſince it appears, that that which is to help theſe Two Cauſes to produce ſuch a Cold, is brought by the Winds, and carried off again; I muſt conclude, that there are frigorific Particles floating in the Air, whether they be Nitre, or by whatever Name the Chymiſts will call them; that they are always acting, unleſs obſtructed by other Cauſes; and that, when they find a proper Recipient, and all Obſtructions be removed, they act with Vigour.

When I ſpeak of the Seeds of Cold, I do not mean, that Cold acts as a Vegetative: Though whoever conſiders the Order that Froſt obſerves in building its Ice upon the Water, will be apt to think, that if it be not the Effect of Vegetation, it is ſomething that reſembles it very near.

It firſt ſhoots out a ſmall ſtrait Twig; then, from the ſame Centre, one on each Side; from theſe main Beams dart out ſmaller Sprigs on each Side, to form the Contignation; then theſe Rafters ſending forth their Sprays, the whole Floor is laid, weak at firſt; but as they gather Strength, they make a Plancher, ſtrong enough, ſometimes, to bear the Weight of whole Armies paſſing over the *Baltic*.

I do not expect, that the Ladies will expoſe themſelves ſo much to the Cold, as to ſee all this: But if they pleaſe to give themſelves only the Trouble to look on their Chamber-windows in a froſty Morning, if they riſe ſoon enough, and they will ſee there ſuch Embroidery made by Ice, as their own Fingers, were they uſed to work, and the fineſt Needles, could not equal.

All this, I ſay, would tempt one to imagine, that there is ſomething vegetative in what I call the Seeds of Froſt. But that is not what I am about at preſent. All I contend for now is, that that which co-operates with the Earth's Surface, to produce Cold, which way ſoever it produces it, is carried to and fro by the Air.

Inſtead of their acting like Seeds, let us ſuppoſe them to act like inanimate Bodies: That each Particle acts with a determined Force; and that, conſequently, the more of them act together, the greater their Effect. Upon this Suppoſition we can eaſily account for the different Temperament of the Air in the ſame Seaſons. For a Continuance of North-eaſt Winds for ſome Years will carry off many of theſe Seeds, or Grains of Cold; and an equal Continuance of South-weſt Winds will bring them back again; and theſe Periods will be longer or ſhorter, according to the Strength or Weakneſs of the Blaſt.

And thus, at length, I have ſatisfied myſelf, till I can find out a better Reaſon, why a cold froſty Winter produces a dry Summer; and a mild Winter a wet Summer. For theſe Seeds of Cold being the chief Cauſe of Froſt, and their Strength being in Proportion to their Number, when the Winter is ſevere, there is ſo vaſt a Quantity of theſe frigorific Particles in *North-Europe*, that their Strength will not ſoon be exhauſted; and, conſequently, that the North-eaſt

Winds will blow long, and make the Summers dry.

But, on the contrary, when the Winter is mild, there are but a few of thoſe Particles in *North-Europe*, not enough to cool the Air there to ſuch a Weight, as to enable it to hinder the South-weſt from reaching us, even in Winter; and therefore, when once the Sun's Heat comes to deſtroy thoſe few, the South-weſt, which is always acting with equal Force, prevails, and brings Rain in Summer.

I make no doubt, but that a Courſe of Obſervations, kept for ſome Years, in ſeveral Places, would reduce the Knowledge of theſe Viciſſitudes of Wind and Weather to ſome Certainty.

I have taken notice only of Two Winds, the North-eaſt and South weſt, as the Producers of a long Run of dry or wet Weather: But if I have hit upon the true Cauſes of thoſe Winds, the ſmaller Variations may be eaſily accounted for. I ſhall mention a few.

Next to thoſe Two, the North-weſt Wind blows longeſt here, and with the greateſt Force, but with various Effects. Sometimes it conſpires with the South-weſt, to blow a mere Storm, with hard Rain; and ſometimes it takes part with the North eaſt, blows dry, and freezes. We are, in a great meaſure, beholding to this Wind, for the little dry Weather we have in a mild Winter.

I take this Wind to proceed from the Continent of *North-America*, where the Cold muſt needs be very intenſe, that can drive the Air from thence hither, with ſuch ſtrong Guſts. It is well known, that Places of the ſame Northern Latitude are much colder in *America* than in *Europe*. Upon Suppoſition that the North-weſt Wind blows from *North-America*, I can, methinks, eaſily account for all theſe contrary Effects produced by the ſame Wind.

Though it blows from a cold to a warmer Quarter, yet it brings Rain at firſt, for this Reaſon, becauſe the Air over the Ocean about us is warmer than that over us. When the North-weſt begins to blow, it muſt drive the Air before it; and then the Vapour that floated in warm Air will fall down with us. Even the North-eaſt, the drieſt and coldeſt Wind we have, will bring Rain, and for many Hours, when it ſets in after a South-weſt.

Hence alſo it is that the South-eaſt and South Winds bring much Rain, and for many Hours together. I take the South-eaſt to come from the *Alps*, and the South from the *Pyrenees*.

I ſhall, at preſent, run no farther into Particulars; my Deſign being only to inquire into the Cauſes of a long Continuance of dry or wet Weather. It would be endleſs to enter into all the Predictions of Weather, that may be collected from Books, and private Obſervations: Moſt of them pretend to foretel the Weather no farther than a few Days. If thoſe Predictions and my Hypotheſis be founded on Nature, they will all admit of the ſame, or of a conſiſtent Explanation.

*N. F.* *Dec.* 31. 1735.

## XI. Notabilia *quædam in* Itinere Alpino-Tyrolenſi *obſervata per* Balthaſarem Ehrhartum, *M. D.* Memingenſem *in Epiſtola ad* C. Mortimerum, R. S. *Secr. miſſa.*

GRatiſſimas tibi perſolvo grates, quod * marmor illud nitidiſſimum juxta meam tenuem ſententiam non belemnitis, ſed trochitis prægnans, amiciſſimis tuis reſponſoriis comitari volueris. Iſtis vero quoque nunc tardius oppoſitas meas haſce non dedignaberis; cum enim ITER CURIOSUM ALPINUM TYROLENSE nuper ſuſceperam, annotata quædam in eo facta, prius aliqualiter digeſta, tecum communicare conſtitui.

1. Emenſis pluribus Alpibus, Helveticas altitudine æquantibus, itinere quinque dierum, nulla mihi, ad hoc unum obtento, occurriſſe marina petrefacta, vel conchitas vel nautilitas; Woodwardi hypotheſin in plurimis falſi arguit. An non & maris tractus æque ſpatioſi dantur incolis vel animalibus marinis plane vacui, ob venas metalliferas, bituminoſas, vitriolicas, ibi uberius in mare hiantes? Ex quo fundamento remedium proceribus Belgiarum, contra Xylophagum aut marinam teredinem propalare ante biennium, ſcripto copioſo, ſuſtinebam. Sed deerat mihi patronus, cui id commendarem.

2. Pro ſermonibus illis ex ſacra cathedra, inſtituto apud vos Boyleano, ad convincendos atheos faciendis, non infimum providentiæ divinæ argumentum largiuntur Alpium diſcrepantes qualitates. In toto itinere

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* *Marmoris* ſc. Darbienſis *fruſtum ab Illuſtriſſimo* Dno Hans Sloane *dono miſſum.*

unicum vidi montem, *Heuberg*, i. e. fœniferum dictum, prope pagum *Pichelbach*, via publica; qui, mirabile dictu, non in ſummo tantum, ſed per omnia latera ad infimam uſque baſin, fœniſecium tam largum præbet, ut pluribus adjacentibus villis, fœno æſtate collecto, pro pecoribus per hyemem eo paſcendis, inſerviat. Deprehendi mechaniſmum, partim humi alentis ſpiſſioris eum tegentis, partim ſubjacentium huic luti margæque venarum, uberrimam laticis fontani copiam, per omnem montis ambitum, ſubtiliſſime exſudantium, eo continuo pororum nexu, quo ſipho inflexus, facta a vicinis altioribus montibus derivatione, imitatur. Novimus enim ſtratis luti argillæque ſubterraneis, DEUM, conditis naturæ legibus, ſub terra in ducendis ſurſum deorſumque aquis, id præſtare, quod homines canalibus ligneis plumbeiſque ſatagunt. Addo his rationibus & illam, quod in iſto monte minor vaporum metallicorum, vegetabilium aliàs radicibus obnoxiorum, proſtet copia. Attamen, his quoque conceſſis, nullam video rationem, quod inter centenos alios montes, retro citroque nullus detur, qui huic mira fertilitate comparetur. Ubi ergo hic neceſſitas phyſica abſoluta? Plane nulla. Sed ſpecimen eſt liberæ voluntatis divinæ, ejuſque providentiæ.

3. Directionem ſtratorum ſaxeorum aliis in montibus, nimium ſæpe, ut dixi, ob cautium ſterilium copiam Libyæ deſertis comparandis, ſæpe conſiderans, miram obſervavi ſtratorum, ex parallelo, obliquo, perpendiculari, perque omnes angulos variationem. Mirum, juxta Woodwardum, ſtrata omnia poſt diluvium exacte ad centrum terræ circularia, vel parallela fuiſſe; hodie vero rariſſimum dari adhuc ſtratum, a diluvianis illis recens formatis reſiduum, cujus

purus paralleliſmus ſaltem per exiguam terræ lineam, vel ad ſpatium unius horæ repertus fuerit. Novi quam diverſa ab iſto expertus fueram, dum hujus præcipue ſtudii gratia Germaniam ante decennium cruciatim, Tiguro Hamburgum, & Dreſda Amſtelodamum uſque peragrabam, jactis prius hic neceſſariis phyſices fundamentis, & perlectis numeroſis auctoribus oryctographis. Interea ex phænomenis illis nuperi itineris Alpini vidi perſpicue, varietatem illam ſtratorum ſaxorum, quibus Alpes componuntur, iterum benignitatis & providentiæ divinæ documentum eſſe irrefragabile; cum ſi horizontalia eſſent montium ſtrata, continua ruina quotidiana eſſet, ſummo incolarum & peregrinantium damno. Contra vero tam mire varianti poſitu ſtratorum, eoque maxime ex *lineis* quaſi *vergentibus* conflato, montes nunc ſtudio æternitati ſtructos, ſole clarius apparere.

4. Demonſtrari poſſe differentiam ſtratorum ejuſmodi mundo creato coævorum, aliorumque poſtdiluvianorum, nullus dubito. Hic Memingæ montes habemus, pluſquam media ſummarum montium altitudine gaudentes, qui in ſummo quoque cacumine ſtrata vaſtiſſima habent ex lapidibus meris palmaris circa, ſed variantis magnitudinis, cæterum rotundatis; illorum plane inſtar in modum, qui a fluviorum curſu & attritu ſic formantur, & in Peireskii vita, errore Gaſſendi, ex muco, neſcio quo, fluviatili concreſcere demum, lepida fabula, narrantur. Jam pro demonſtrato habemus lapidum illorum omnium vaſtiſſimam congeriem quaſi ſupramontanam, cum fluviolus nullus ibi pertingat, ab aquarum torrenti formari haud potuiſſe. Multo minus formationis illius medium, quem in Acad. Reg. Pariſ. Commentariis

tariis D^n. *de Reaumur* ingenioſe protulit, hic locum habere poſſe. Accedit enim alterum a me detectum phænomenon, quòd a Meminga verſus Alpes lapides iſtos diametro creſcentes deprehenduntur, ſic ut tandem maſſas vel truncos triquadripedales æmulentur; ſed a Meminga verſus plagam oppoſitam, & ab Alpibus remotiorem, decreſcit magnitudo iſtorum lapidum, ſucceſſive ſemper minorum, uſque dum denique ad arenæ groſſioris ſpeciem recedant. Hanc inſignem pro telluris theoria obſervationem augeo ſequentibus partim obſervatis, partim corollariis.

Integra obſervavi inter Tyrolenſes Alpes montium juga, quæ in *continua* rupe eo præciſe gaudent lapidum genere, quo ultimo dicti illi inter Alpes & Danubium ſiti montes gaudent in *diſcretis, detritiſque* lapidibus.

Lapidum iſtorum tot varietates ſunt, quot rupium illarum Alpinarum.

Cauſa quæ rupes Alpinas fregit, & fragmentis inde, raptu undarum mutuo attritu rotundatis, totam meam, quam inhabito, Alemanniam, inundavit, nulla alia quam diluvium maximum, dubito tamen an Noachicum, eſſe poterit.

Talis diluvii undæ, in eodem tractu, viginti leucarum longitudine, nec minori latitudine, tum temporis, eadem directione ab auſtro ad ſeptentrionem dirigebantur.

Tum attritu undarum vorticumque ex confractis Alpibus, ante diluvium duplo altioribus, orta fragmenta, quo magis provolvebantur, eo magis comminuta ſunt. Unde loca Alpibus vicina majoribus fruſtis premuntur; ab iis vero remotiora, minoribus, imo fere in groſſioris arenæ formam comminutis gaudent.

Exactiſſima ſimilitudo iſtorum quoviſmodo comminutorum lapidum; & rupium Alpinarum maximarum, ceu ex ruina ſuperſtitum, illorumque patriam repræſentantium; oculariter demonſtrari poteſt.

Inter illa tamen notabiliſſima fruſta, quibus integra Sueviæ ſuperioris provincia inundata eſt, hactenus nulla vidi ex vena metallifera conflata, prout inter Alpes integri montes largius metalliferi dantur. Ergo ante diluvium aut venæ metalliferæ ſuperjectis montium molibus tectæ erant, aut in fruſtis illis exſpirârunt ramenta metallifera. Metallicolæ iſta *exſpirare*, *Verwittern*, vocant, quod explicatu facile erit ſuo loco. Unde tot inter illos lapides Alemannicos occurrunt, favaginis inſtar foraminati ubique & exeſi.

5. Plantas inter rariores, Alpinas, in itinere iſto, menſis Septembris initio, occurrerunt:

Acetoſa lanceolata, Alpina, rotundifolia. N. Acini pulchra ſpecies. J. B. 3. 260. Cacalia tomentoſa. C. B. 198. Cardamine Alpina. Cluſ. Pannon. Caryophyllata Alpina chamædryos folio. Boerh. 45. Cotoneaſter. J. B. 1. 73. Cratægus folio ſubrotundo ſerrato, ſubtus incano. Tourn. 633. Daucus montanus multifido longoque folio. C. B. Dioſpyros. J. B. 1. 75. l. Myrtomelis Geſneri. Doria quæ Jacobæa Alpina. C. B. Pr. 66. Erica arboreſcens, floribus luteolis vel herbaceis. J. B. 3. 356. Horminum luteum glutinoſum. C. B. 238. Larix folio deciduo conifera. J. B. Chamærhododendros Alpina villoſa. T. 604. Quinquefolium album 1. Cluſ. J. B. 2. 398. Pinaſter Alpinus pumilio. Cluſ. Pannon. Sedum minus flore luteo. J. B. 694. Siler montanum minus. Boerh. 52. Vitis Idæa foliis oblongis albicantibus.

C.

C. B. 470. Gallium ſaxatile ſupinum, molliore folio. A. R. P. 1714.

6. De fodinis ſalis Halæ Tyrolenſium a me perluſtratis pauca hic refero. Dum quilibet inter Alpes mons mundum integrum repræſentet, ſuumque clima torridum, temperatum, & frigidum habeat; illa jugi montani pars, quæ ſalis fodinas continet, auſtro expoſita eſt ſummopere, ſolibus æſtivis in pluribus lateribus torretur, mea ſententia magis, quam terræ lineæ æquinoctiali ſubjacentes.

Concomitatus, vel nexus, ac συζυγία foſſilium, phænomenum eſt hactenus parum notum, ſed ſingulare, ac nuſlibi negligendum. Halæ Saxonum ſalinas comitantur gryſei lapides argilloſi, molliores; deſuper ſtrata jacent lapidis rubeſcentis marmorei nonnihil, cui glomeres quaſi ſpathi aut ſeleniticæ materiæ innaſcuntur. Non procul a ſalinis, copia bituminoſi foſſilis aut carbolithi præſto eſt. Sic & Halæ Tyrolenſium tum magna voluptate ſimilem plane foſſilium concomitatum obſervavi, differentia nulla inter illas atque has, quam quod ibi ab ipſa natura, hic artis ope, aqua ſale foſſili ſaturetur. Salis enim vena vel foſſile ſal hic obveniens cœnoſum, cameris ſubterraneis eum in finem excavatis elutriatur, & ex muria hoc modo parata ſal coquitur. Mirabile dictu cœlum cameras ejuſmodi tegens, lapideum eſſe, pavimentum vero argillaceum. At ejuſmodi ſtructura plurimæ Alpes gaudent quibuſdam partibus, ut iterum potentiæ divinæ ab humana architectura diverſiſſimæ documenta largiantur. Sed falſa eſt Becheri relatio, ſpoliatas ſale foſſili per aquæ admiſſionem cameras ſubterraneas vel cuniculos, ſubinde dein renato ſale iterum repleri. Hoc vero primus ego detexi, ex limo illo nigro, ſale foſſili interjacenti per elutriationem privato, efflorefcere dein nitidiſſimis ubique aculeis ſal amarum Epſonienſi ex aſſe ſimile, ut Tyrolenſes, ſi vellent, ejus maximam quantitatem parare, ac reliquæ Germaniæ id in locum Anglici ſalis ſurrogare poſſint. An tamen alicubi ſub terra ſal foſſile adhuc generetur per modum vaporum, nondum reſcire potui: Ipſi tamen foſſores de ſuffocantibus ſubterraneis halitibus nil ſciunt, quos in Saxoniæ metallifodinis notiſſimos habent, & *Schwaden* vocant.

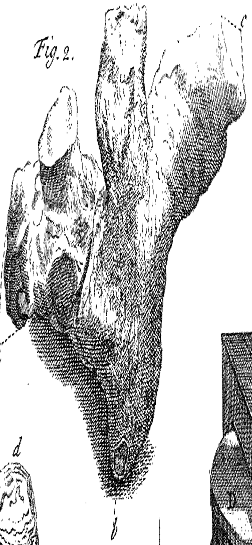
Unicum addo, de dialecto linguæ Alemanicæ vel ſuperioris Sueviæ; eam tot diphthongis, talibus pronunciandi modis, & vocibus plane ſimilibus gaudere; ut qua literam, Anglicæ, præcipue Wallicæ linguæ, ſimillima ſit illa, ſimulque omnium maximum documentum præbeat, Suevos & Anglos antiquiſſimis temporibus unam eandemque fuiſſe nationem. Quod ex hiſtoriis ob vetuſtatem probare difficile, ex iſto vero argumento facillimum erit. Cujus tamen explanationem alii tempori reſervo.

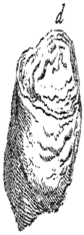
Nunc jam nimiam epiſtolæ prolixitatem, vir eruditiſſime, deprecor. Nolui ſaltem, tuo juſſu excitatus, qualibuſcunque meis indiciis Regiæ apud vos ſocietati levidenſes in H. N. conatus meos deſignando deeſſe. Tuæ vero dominationi, propter veteris amicitiæ documenta, obſtrictiſſimus manebo. Vale & fave; quamque primum negotia permiſerint, reſcribe. Datum Memingæ, die 10 Maii 1735.

*LONDON:*

Printed for T. WOODWARD, and C. DAVIS, over-against *Gray's-Inn-Gate* in *Holbourn*; PRINTERS to the ROYAL SOCIETY.

Fig. 2.





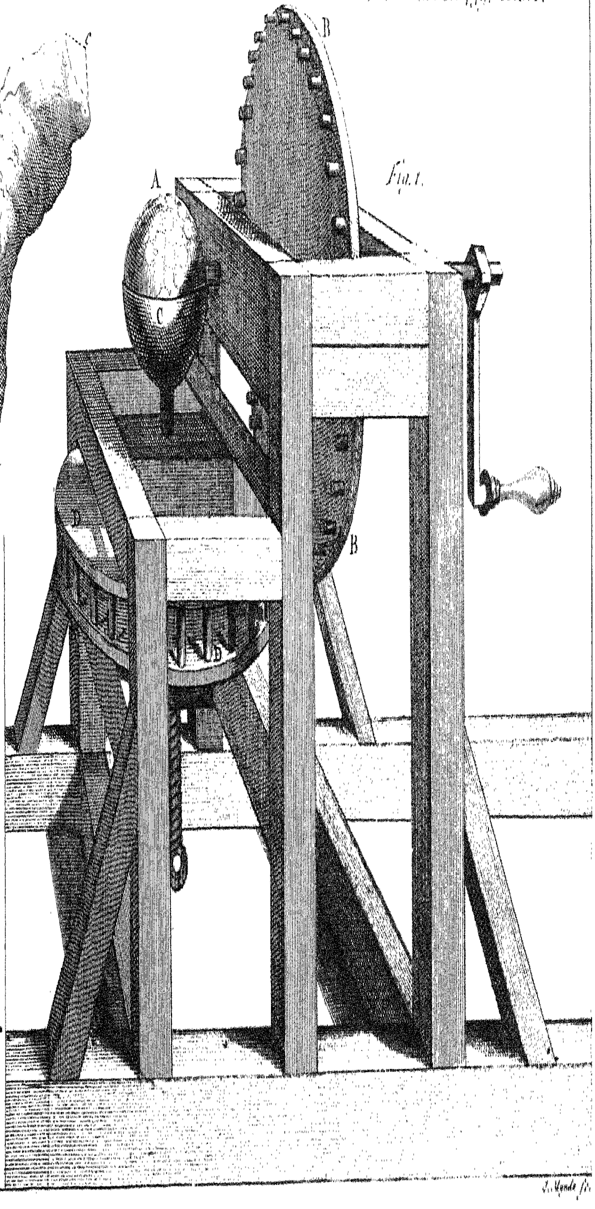
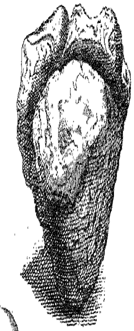


Fig. 1.

Fig. 3.



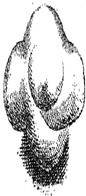
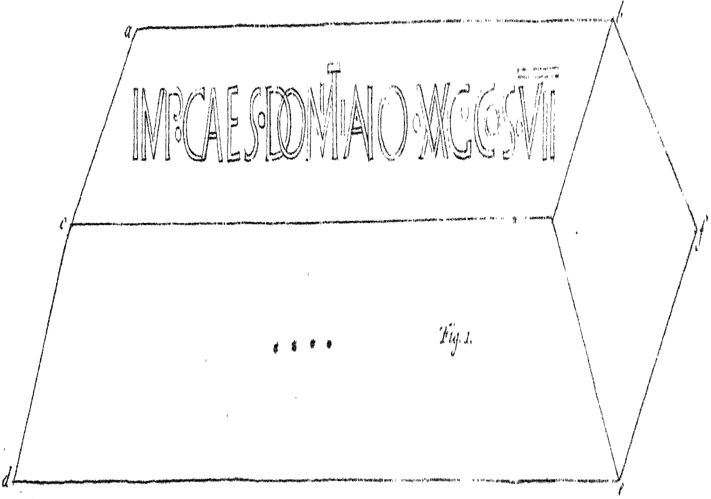


Fig. 4.

J. Mynde sc.



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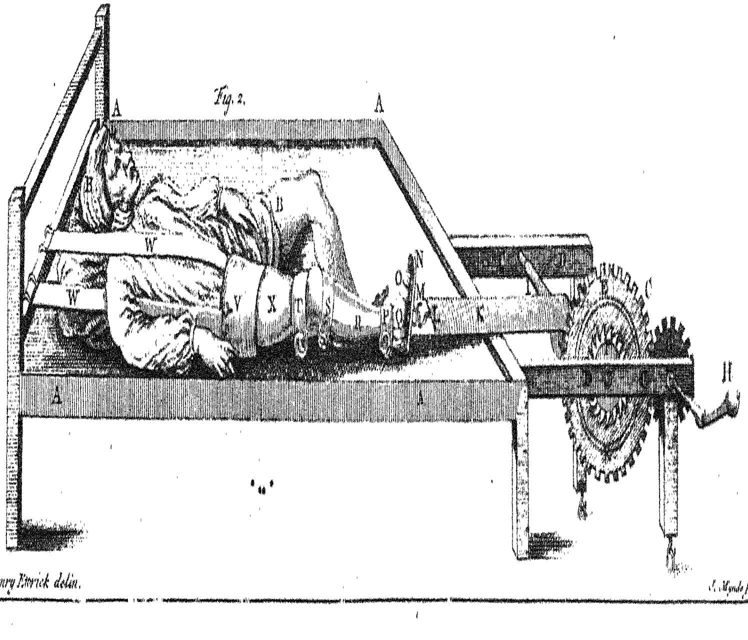

Fig. 2.

Henry Ettrick delin.

J. Mynde sc.

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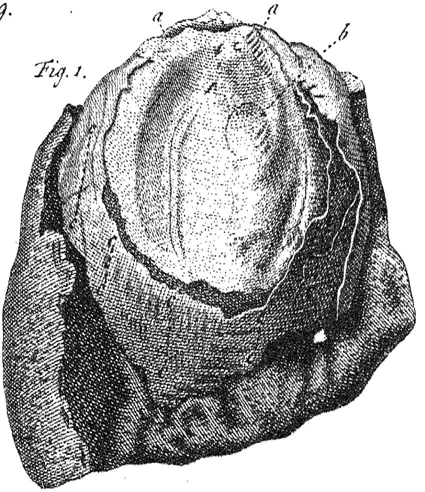
Fig. 1.



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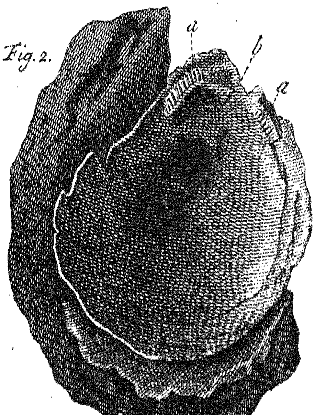

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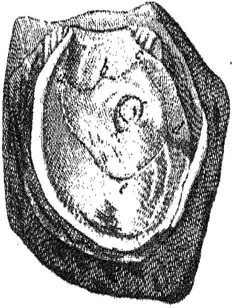

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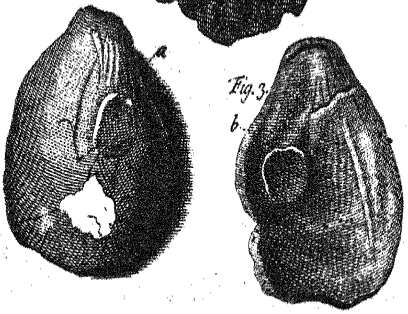

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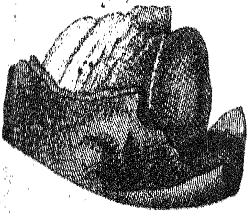

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TAB. IV.

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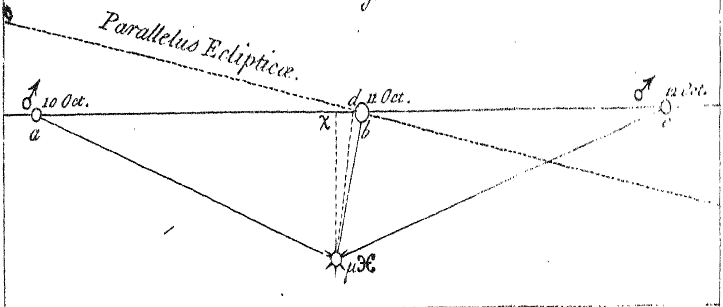

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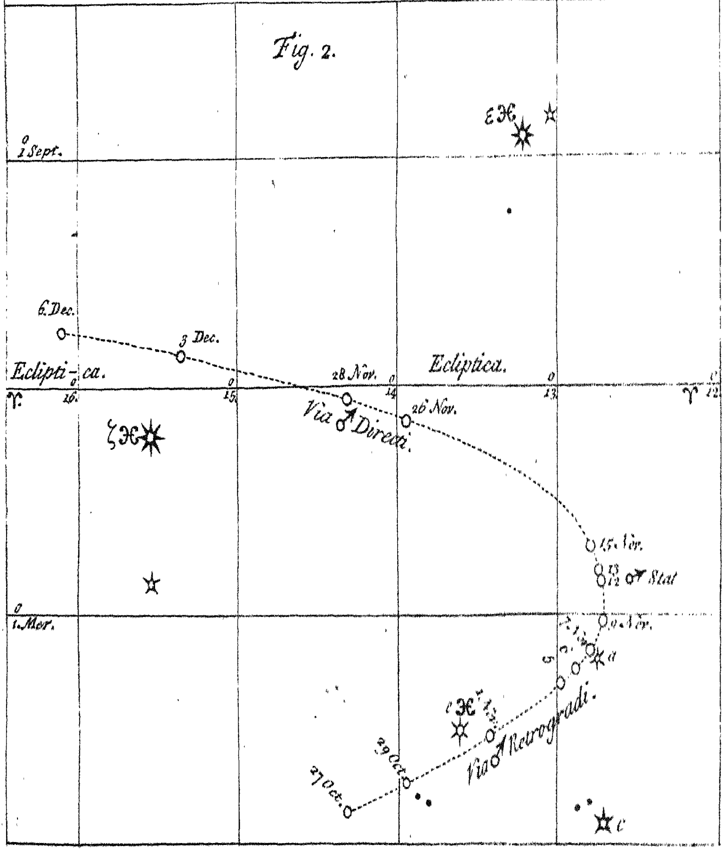

J. Mynde sc.

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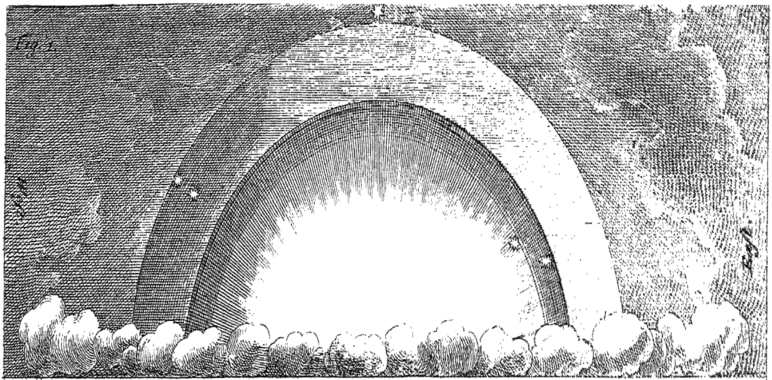

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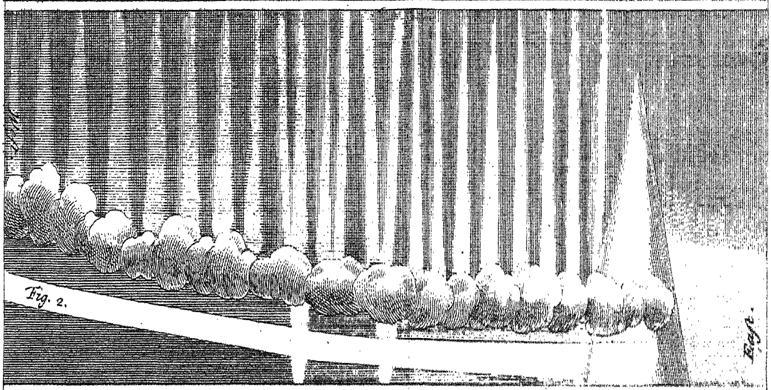

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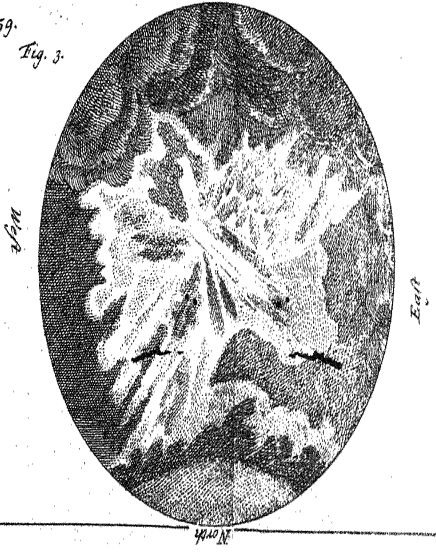

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Numb. 459.

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## I. *The Figure of a* Machine *for grinding* Lenſes *ſpherically, invented by Mr.* Samuel Jenkins, *and communicated by him to the Hon^ble Sir* Hans Sloane, *Bar^t. Pr.* R. S. *&c.*

*SIR,*

THE Advantage it would be to have *Lenſes* of the ſpherical Kind, Segments of a true Sphere, hath occaſioned the Invention of many Machines and Methods of Grinding, in order to produce ſuch Segments: But nothing hitherto made public hath anſwered the End propoſed.

The beſt Methods now in Uſe will only produce an Approximation to a truly ſpherical Figure, but demonſtrably not one, though the Artificer ſhould employ the utmoſt Skill and Care in the Uſe of the beſt Machines hitherto invented: And indeed, at preſent, Gentlemen have nothing to depend on, that their *Lenſes* are nearly ſpherical, but the Care and Integrity of the Workmen; in which how often they are deceived, is too obvious to every one who hath Occaſion to uſe ſuch *Lenſes*.

I therefore beg Leave to ſubmit to your Conſideration the Effects of a Machine, of which the incloſed is a Repreſentation [TAB. I. Fig. 1.]; which, as it is contrived to turn a Sphere at one and the ſame time on Two Axiſes which cut each other at Right Angles, with equal Velocity and Preſſure on each of them, I conceive it is demonſtrable, that (without any Skill or Care in the Workman) it will produce a Segment of a true Sphere, barely by turning round the Wheels; which if ſo, the Conſequences will be,

1ſt, That all Grinders of ſuch Glaſſes, *&c.* will gladly uſe them; a labouring Man, whom they hire for leſs Wages, being, by the Help of this Machine, able to do more Work in a Day, than a skilful Artificer, without it, in Two Days. And,

2*dly*, All Gentlemen will have the Pleaſure to know the *Lenſes* they make uſe of are truly ſpherical, it being impoſſible this Machine ſhould produce any other Figure.

If you think this Contrivance of Importance enough to be offered to the ROYAL SOCIETY, you will do me a great deal of Honour to communicate it from,

*SIR,*

Eſſex-Court,
Nov. 29. 1737.

*Your moſt obliged*
*Humble Servant,*

Samuel Jenkins.

Explanation of Fig. 1. TAB. I.

A. *A Globe covered with Cement, in which are fixed the Pieces of Glaſs to be ground. This Globe is faſtened to the Axis, and turns with*
B. *the Wheel* B.
C. *Is the braſs Cup, which poliſhes the Glaſs: This is faſtened to the Axis, and turns with*
D. *the Wheel* D. *So that the Motion of this Cup* C *is at Right Angles with the Motion of the Globe* A.

II. *Ob-*

## II. *Obſervatio de immodico & funeſto Lapidum Cancrorum, ſimiliumque terreſtrium Abſorbentium Uſu, indeque ortis Calculis in Ventriculo & Renibus:* à Joh. Philippo Breynio, *M. D.* R. S. *S. cum D.* Hans Sloane, R. S. *Pr. &c. communicata.*

NUllam fere in corpore animali dari cavitatem, in qua non aliquando calculi generati & reperti ſint, practicorum teſtantur obſervationes; immo quotidianus clamat rerum uſus.

Inter rariores tamen merito numerandi ſunt calculi, qui in ventriculo corporis humani generantur. Horum nonnullæ licet in lucem, a quibuſdam viris doctrina & arte claris, jam editæ ſint hiſtoriæ, quædam quoque tibi, Vir Illuſtris, non ignotæ proculdubio fuerint, non tamen me oleum & operam, quod aiunt, perditurum confido, ſi ſequentem tecum communicavero; utpote quæ tum ratione originis, tum configurationis calculorum, quotquot hactenus publicatæ ſunt, varietate, quantum ego novi, ſuperare videtur. Generoſus nimirum D. Robertus Hacket Anglus, Eques Auratus, corporis conſtitutione athletica, & valetudine gaudens proſperrima, (niſi quod aliquando cum morborum tyranno, podagra ſcilicet, miſere confligaretur) genio ſuo, ut ſæpius ſolent Generoſi, vinoque ſubinde indulgens, in inſula Americæ Barbados dicta, quæ Britannorum paret imperio, degebat. Hic a multis jam annis ſubinde, inprimis ſi Baccho liberalius aliquantulum litaverat, cardialgia, quæ

Anglis,

Anglis, apto ſatis, vocabulo vernaculo, *Heart-burn* ſalutatur, corripiebatur; ad quam tollendam pulverem oculorum cancrorum, ſimiliave acidum obtundentia terreſtria frequentius aſſumebat. Ex his levamen quia pro tempore ſaltem obſervabat, indies redeunte cardialgia, lapidum cancrorum, cretæ, teſtaceorum, & ſimilium uſum ſingulis diebus in magna doſi per plurimos continuavit annos: ſed funeſto plane eventu; cardialgia enim non tantum inde increvit, ſed & moleſtiſſimus gravitatis ſeu ponderis ſub diaphragmate ſenſus acceſſit, concomitantibus ſubinde vomitu & intenſiſſimis doloribus nephriticis; donec tandem, anno ætatis ſuæ quinquageſimo ſexto, poſt natum Chriſtum vero, ſi recte memini, 1694. miſere excruciatus animam redderet.

Cadaver, cum agnotorum venia, a duobus chirurgis fuit apertum; qui in ventriculo ingentem calculorum variæ admodum magnitudinis reperere numerum; quorum maximus magnitudine, & figura ramoſa, qua corallium exprimit, imprimis notabilis, figura 2. Tab. I. exhibetur; prouti a filio patientis, Generoſo D. Wilhelmo Hacket, hoſpite quondam, dum Oxonii degerem, meo amantiſſimo, cui totam hanc hiſtoriam debeo, anno hujus ſæculi tertio aſſervabatur, mihique cum cæteris demonſtrabatur, qui, deperditis licet aliquot, ut figura indicat, extremitatibus, uncias tamen medicas adhuc pendebat duas cum drachmis quinque.

Hic proximus fig. 3. expreſſus unicam unciam cum una æquabat drachma. Cæteri vero longe minores, a magnitudine ſcilicet ſeminis papaveris ad piſi majoris, aſcendebant, ſphæricæ, vel ad ſphæricam accedentis figuræ.

Hi calculi omnes in ventriculo involuti fuerant humori admodum mucoſo, & tenaci, qui in charta aëri expoſitus & ſiccatus abiit in pulverem ſimillimum ſubſtantiæ dictorum calculorum.

Subſtantiam verò eorum quod attinet, notandum eſt, eam non ubique ſuiſſe eandem; utplurimum enim coloris erat albicantis & cineracei; & in quibuſdam lapidi bezoar occidentali conſiſtentia & colore, in aliis vero paucioribus, ut præſertim Fig. 2. lit. *a* & *b*, lapidi bezoar orientali ſimilis; *d*, extremitatis abruptæ; *c*, ſuperficiem exprimit; ut interna lamellata pateat ſtructura.

Præterea & in rene calculus fuit repertus trium drachmarum pondere, qui ex ſex ſphæris quaſi videtur compoſitus, ut fig. 4. indicat, ſubſtantia cæteris in ventriculo ſimilis ferme. Calculi in ventriculo mulieris cujuſdam reperti, noſtro majori multum ſimile exemplum, exhibet, addita figura, Wilhelmus Clerk, in Tranſactionibus Philoſophicis Anglicanis, N° 250.

Aliud exemplum calculi ventriculi vid. in Ephemerid. Nat. Curioſ. D. 1. Ann. 2. Obſ. 181. cum Scholio Philippi Jacobi Sachſii.

*J. P. Breynius.*

III. A

## III. *A Letter from the Rev$^{d}$ Mr.* S. Kirkſhaw *to* William Sloane, *Eſq;* F. R. S. *concerning Two* Pigs of Lead, *found near* Ripley, *with this Inſcription on them,* IMP. CÆS. DOMITIANO AUG. COS. $\overline{\text{VII}}$.

*Ripley* near *Barrowbridge,*
*Dec.* 15. 1735.

*Hon$^{d}$ SIR,*

I Beg your kind Acceptance of the Incloſed: It is a Draught of One of the Two Pieces of Lead, now in the Poſſeſſion of Sir *John Ingilby*, Bart. of this Place, which were found, in *January* laſt, on *Hayſhaw-Moore*, Two Miles South of *Patley-Bridge*, a ſmall Market-Town in this Neighbourhood, by a Countryman, whoſe Horſe's Foot ſlipping into a Hole covered with Ling, he diſmounted, and, thruſting his Stick into the Hole, perceived ſomething hard, and of the Sound of Metal; and, by digging, found theſe Two Pieces of Lead, ſtanding upright, and near each other, about Two Foot under-ground. They are of the ſame Shape and Dimenſions, and have the ſame Inſcription. One of them weighs Eleven Stone, the other Eleven Stone and One Pound. The Dimenſions I have marked at the End of this Letter; the Draught [TAB. II. Fig. 1.] is as juſt a one, as any Perſon I could meet with in the Country, and at this Time of Year, could take. The Inſcription is ſuch as is upon the Leads, to a great Exactneſs, inſomuch that every Irregularity of the Letters is noted: Only it may not be amiſs to add, that the Letters are raiſed, and very bold. There have been Four other Letters on the Side of each of them, whereabouts I have made the Four Dots in the Draught, but they are grown ſo obſcure, that I cannot diſcover them with any Certainty.——They ſeem to have been B. N. I. G. . . . The great *Roman* Cauſeway leading from *Aldborough*, in this Neighbourhood, into *Lancaſhire*, paſſes within a little Way of the Place where the Leads were found. There have been no Lead-Mines, as far as can be known, within ſome Miles of it: But a Countryman informs me of a large Rock, about half a Mile from it, on the Top of which there is an Impreſſion ſimilar to either of the Leads, only ſo much larger as to admit of a Pan, wherein they might be ſmelted, if in ſo early Time they knew the modern Art of ſmelting by the Air. As yet, I have not had an Opportunity of viewing this Rock; ſo that this I have only from Hearſay, though I believe it is credible enough.

Theſe, Sir, are all the Particulars it ſeems proper to trouble you with concerning theſe Pieces of Lead. I ſhould only ſhew my Ignorance and Impertinence, if I did not leave it to the learned and curious Members of your SOCIETY, to determine the Original and Deſign of them: Only give me Leave to obſerve, that *Camden* mentions Twenty Pieces of Lead of this kind, found in *Cheſhire*, Part of them with this Inſcription, IMP. DOMIT. AUG. GER. DE. CEANG. . . . *Camden*'s *Britan.* Fol. Edit. p. 679.—And moreover, that among the Duke of *Parma*'s Medals, publiſhed by *Paolo Pedruſi*, I do not find any ſtruck in the Seventh Conſulate of *Domitian*, but what have the Addition of *Divi Filius*, or the like.—That

Author too ſays, that the Firſt Year of *Domitian's* being Emperor was the Eighth of his Conſulate; neither of which agree with the Inſcription on the Leads.——

I am,
*Honoured SIR,*
*Your moſt obliged,*
*Obedient Servant,*

S. Kirſhaw.

The Dimenſions of the Piece of Lead, Tab. II. Fig. 1.

| | | |
|---|---|---|
| From *a* to *b*. | —— | 21 Inches. |
| *d* to *e*. | —— | 23 ½. |
| *a* to *c*. | —— | 3 ½. |
| *e* to *f*. | —— | 5 ½. |
| Perpendicular Depth | | 4. |

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## IV. *The Deſcription and Draught of a* Machine *for reducing* Fractures *of the* Thigh, *by Mr.* Henry Ettrick, *Surgeon.*

Having frequently conſidered the many Inconveniencies, and great Difficulties, attending the common Methods of Reduction, I determined with myſelf to attempt a Form more mechanical and certain. I immediately fixed on the Axle and Wheel, as the moſt ſimple, and yet fully capable of taking in and ingroſſing all and every Advantage neceſſary towards the well reducing of Fractures, *&c.* It conſiſts of no more than a Wheel and Pinion, with their Axles; the Roch, or ſnagged Wheel, being herein accounted as Part of the great Wheel, fixed in a light Frame of about Two Feet long, [ ſee Fig. 2. TAB. II.] the Whole not exceeding the Weight of 15 Pounds; and when taken to Pieces, by unſcrewing the Frame-pieces, may be packed up in a common Ruſh-Basket, belted to the Side, and conveyed to any Diſtance. Again, the Room it takes up in working is not a full Yard, and may be ſet up and fixed for Uſe in a few Minutes. In uſing this Machine, the Surgeon need but one Aſſiſtant; whereas, in moſt other Methods, their Number is moſt troubleſome and inconvenient: The Buſineſs of this Aſſiſtant is no farther than to mind the Surgeon's Orders, and move the Winch according to his Direction. When the Extenſion is ſufficient, the Engine ſtays itſelf, and continues the Tenſion of the Limb, by the Aſſiſtance of this Roch, or toothed Wheel, whoſe Teeth are cut fine enough to ſtay the Engine at every Line of an Inch, and which is fixed on the Back of the aforeſaid great Wheel, both to the Croſs by the Help of Screws, and on its Arbor by having its Centre ſquared out, ſo as to fix tight thereon, and ſo near the Frame as only to allow a bare clearidge: Its Teeth, ſtanding counter to the former, admit the Spring or Catch fixed on the Inſide of the Frame, to ſlip over the Vertex thereof, without Interruption; but in a reverſe Rotation, or when the Engine is about to come up, flies into the Spaces thereof, and ſtays the ſame: The upper Part thereof projects about an Inch from the Frame, ſo that being preſſed upon by the Finger of one Hand, the inferior Part is elevated above the Range of the Teeth, to admit the coming up of the Engine, which is to be directed by the other Hand being applied to the Winch in any Degree. This Engine has its Power ſo commanded, that it may be uſed without Reſtriction, from the moſt robuſt to the moſt tender Frame, ſeeing it acts and exerts its Power in proportion to the Reſiſtance made. Farther, as hinted at before, it is enriched with all thoſe Properties which Authors affirm neceſſary to a ſucceſsful Operation; for this Extenſion, according to their Obſervation, is made deliberately, ſteady, equally, and in one continued Line, without the leaſt Variation. And further, in oblique Fractures of the Thigh, where the Bones are apt to ride, (and therefore, on that Account, require a continued Extenſion in a certain Degree, to prevent the Limbs ſhortening after the Cure) ſuch a Machine muſt be of excellent Service; having the Property of increaſing or decreaſing the Extenſion at Pleaſure, and to be perfected without the leaſt Jar or Tremor.

The neceſſary Appendages are Bands, by which the Engine extends the Limb; and deſerve the following Obſervations: Immediately from the Axle of the great Wheel comes a Girt, at the other End of which Girt is a Hook, which links into a Swivel-Ring at the Bottom of a Sole-plate: This Sole-plate anſwers the Shape of the Foot, and is made of well-hammered Braſs, the Inſide of which is padded, to ſit eaſy to the Foot: The upper Part hath a Strop fixed thereto, which claſps over the upper Part of the Metatarſal Bones; and to keep the Strops ending in the Sole-plate from galling or preſſing the Sides of the

Foot and Ancle, there project Two Arms from the Sides of this Sole-plate, to which the Strops coming from the Ancle-band are faſtened. That the whole Limb may be kept in a Line with the Machine, the Leg is ſuſpended by Bands, one of which is placed at the Ancle, from the Sides of which paſs Two Strops, to join the inferior Knee-band: From this Band paſs Two Strops to the ſuperior Knee-band: All theſe Strops are deſigned to divide the Extenſion, ſo that all Parts may equally bear alike, and ſo to ſecure the Joints of the Limb from the Violence of the Extenſion. The Inſide of theſe Strops are lined; the Bands incircling the Limb are contrived in the ſame Manner as the Bow or Spring of a Truſs, having ſtrong Claſps at the Ends, after the Manner of thoſe for Pocket-books, to fit any Dimenſions. The Band embracing the Part above the Fracture, and from which paſs Two Strops to the Head of the Bed, to make the Counter-extenſion, is of the ſame kind as the former, and is to be kept on, the whole Time of Decumbiture, to prevent the Patient's Body ſinking on the Fracture, and thereby contracting the Limb. The exterior of the Two laſt-mentioned Strops preſſes juſt beneath the great *Trochanter* on its Outſide; the other comes from the anterior Part of the ſame Band, and in ſuch a Scite as to give the Patient Liberty to raiſe himſelf at Diſcretion. To preſerve the natural Curvity of the Thigh, it would be neceſſary to have a large broad Band ariſing from the Bedſide, to encompaſs the fractured Part, and keep it ſteady.

## Explanation of Figure 2. TAB. II.

| | |
|---|---|
| A. A. | *Repreſents the Bed.* |
| B. | *The Patient.* |
| C. | *The Machine at the Feet of the Bed.* |
| D. D. | *The Frame.* |
| E. | *The great Wheel.* |
| F. | *The Roch-wheel, with a Catch and Spring, to prevent the Wheel going back.* |
| G. | *The Pinion.* |
| H. | *The Winch.* |
| I. | *The Arbor of the great Wheel, whereon* |
| K. | *the Girt* K *is ſixed: The Diameter of the Barrel thereon is Two Inches.* |
| L. | *The End of the Girt ſixed by* |
| M. | *the Ring* M. *to* |
| N. | *the Sole-board* N. |
| O. | *The Band which paſſes over the Inſtep.* |
| P. | *The Ancle-band.* |
| Q. | *The Strop which paſſes from the Sole-plate to the Ancle.* |
| R. | *The Strop continued from the Ancle to the Knee.* |
| S. | *The Knee-band.* |
| T. | *The ſuperior Knee-band, with the Strop continued, as before.* |
| V. | *The Band embracing the Part above the Fracture.* |
| W. W. | *The Counter-ſtrops paſſing to the Bed's-head.* |
| X. | *The lateral Band to preſerve the Curvity of the Thigh-bone.* |

*P. S.* I thought it would not be improper, if I ſhould attempt to demonſtrate to what great Exactneſs Machines of this Nature may be made to operate.

A Specimen of which I beg Leave to preſent as follows: Admit the Barrel 4 Inches Diameter, the Roch-wheel to be cut with 48 Teeth, the great Wheel to have 32, anſwerable to a Pinion with 8. The Reaſon of pitching on a Barrel of this Dimenſion is, that it may be more preciſely judged what Extenſion has been made; for repeated Revolutions of the Girt upon the Cylinder, in extending, would, by its uncertain Increaſe, ſubject the Judgment to err; whereas the utmoſt Extenſion required comes within one Revolution of this Barrel. The Teeth of the Roch to be numbered at every Fourth, which will be at every Inch, and equals in one Revolution the Periphery of the Barrel; conſequently every Tooth of this Roch will ſtretch the Limb One fourth of an Inch: So though the Spring or Catch to the ſaid Roch ſhould paſs the capital Numbers, and ſtop in the Interſpaces thereof, it is only counting from the laſt capital Number to the Place where the Spring is, and that gives the Parts of the Inch: By the ſame Rule the Winch, every Turn it makes, will gain a Fourth of this Wheel, which will be 3 Inches, or 12 Teeth; and 4 Revolutions thereof will anſwer to the Periphery of the Barrel: So by meaſuring the ſound Limb, and comparing the fractured therewith, the Extenſion required may be nearly demonſtrated. With the Uſe of this Machine, I ſhould recommend the 18 Tail Bandage to the circular Rollers of *Hippocrates*, ſince they are both leſs troubleſome to the Surgeon, and leſs painful to the Patient; nor yet ſo liable to wreath the Muſcles, and diſtort the Ends of the fractured Bones.

And to render this Machine of the like Service at Sea, where we are in the greateſt need of Helps of this Nature; I have deſigned a Bed to ſwing and yield to the Ship's Motion, whereon the Patient is to be laid, with the Engine thereto fixed, that the frequent Diſcompoſure and Diſturbance given to the fractured Part by the Ship's rolling and working at Sea, may be prevented.

## V. *De* Oſtreis Petrefactis *Relatio* Cornelii le Bruyn, *Illuſtrata per* Jac. Theodor. Klein, *R. S. S. Reip.* Gedan. *a Secret.*

INdefeſſus peregrinator Cornelius le Bruyn [*] inter alia ad hiſtoriam naturalem notatu digna, *pag.* 480. *ſeq.* oſtrea exhibet, quorum non ſolum valvas petrefactas, ſed & animal ipſum intra conchas in lapidem mutatum offendit.

Prima facie & narratio & figuræ, quas dedit, ſuſpectæ videbantur, magiſque fidenter quam vere traditæ. Audiamus auctorem:

" A quelque milles de Nicoſie il y a une petite
" montagne, qui n'eſt que d'huitres petrifiées — les
" ecailles en ſont ſerrées l'une contre l'autre, et, lorſ-
" qu'on les ouvre, on voit l'huitre des deux cotés des

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[*] *Voyage, Tome Second,* à Paris & Rouen 1725. 4°.

" ecailles, ſi bien conſumée, qu'on diroit, qu'elle y eſt
" gravée. Ces ecailles ſont auſſi petrifiées, ou chan-
" gées en pierre — J'en ouvris une — au milieu de
" laquelle on voit l'huitre toute entiere, &, en
" même tems, comment elle paroit gravée dans
" l'autre ecaille."

Non admirabar teſtas in lapidem verſas, ſed oſtreum animal petrefactum mirum audiebat; nec ſufficere videbatur ratio hujus phænomeni, quam auctor probabilem ratus eſt, verbis:

" Quand on ôte le ſable de la premiere ecaille,
" on voit l'huitre, qui eſt de même conſumée par le
" tems, d'ou il faut conclure, que ces huitres y ont
" été vivantes, & que l'eau s'étant ecoulée, le ſable
" a inſenſiblement pris la place, & que l'huitre en
" mourant a imprimé la forme dans l'ecaille — Ainſi
" il en eſt de ces huitres, comme de ces pierres, ou
" l'on voit un poiſſon."

Vix enim intelliges, quid ſibi velit moribundi oſtrei (animalis mollis, facile corruptibilis) FORMA teſtis ſuis ante impreſſa, quam ipſæ teſtæ (natura duræ) abierunt in lapidem; neque ſtatim ibis in ſententiam auctoris: Quod non ſuperet poſſibilitatem, ut oſtreum ſui figuram imprimeret teſtis pari modo, quo ſceleta piſcium SCHEMATA ſua relinquunt poſt ſe in materia terrea ſubacta, quæ poſtmodo vertitur in lapidem plerumque ſciſſilem.

Itaque operæ pretium eſſe duxi, hanc relationem ad captum accommodare, & in clariore luce exponere ſchematibus LITHOSTREI, quod integrum ex lapide duriſſimo montis Zigarorum (*Zijanken-Berg*) prope Gedanum anno 1736. feliciter excuſſi.

In anteceſſum autem monendum, 1. Lapides Gedanenſes figuratos, varia multaque inſolita ex regnis vel animali vel vegetabili continentes, inprimis montium, qui a grandine (*Hagels-Berg*) & a Zigaris nuncupantur, ac vicinorum, ex argilla & luto cum tantillo arenæ mixtis eſſe fictos, cinerei coloris, plerumque duriſſimos, adeo ut tudite ferreo cæſi ad inſtar vitri foſſilis *Imperati*, ſive lapidis cornei vulgatiſſimi, ſubnigri, i.e. culinaris, diſſiliant. 2. Quod præ reliquis oſtracomorphitæ teſtas ſive cochlidum ſive concharum foveant ſæpiſſime integras, petrefactas quidem, coloribus naturalibus tamen plerumque & optime diſtinguendas; aliquando, ubi matrix (quæ vulgo audit) minus compacta vel dura eſt, partim quaſi calcinatas, partim in lapidem verſas.

Jam in prætacto lithoſtreo, niſi fallor, ſeſe manifeſtabunt phænomena, quæ celebris Cornelius le Bruyn in relatione ſua, licet obſcura, fortaſſe nobis exponere voluit; in quem finem,

Hujus lithoſtrei partes, valvis ejuſdem circumſpecte recluſis, exacte ac vivis coloribus pingi curavi, TAB. III.

Fig. 1. exhibet teſtam inferiorem complanatam, tenaciter in lapide duriſſimo hærentem, ex genere oſtreorum ſaxatilium; de quibus vid. *Liſter. de Cochl. Tit.* XXVII. p. 182. cardine utrinque canaliculato, vel ginglymis

*a, a*, inſtructo.

*b*, Manifeſtum veſtigium validi tendinis, quo mediante animalculum valvas & ad plauſum aperit & claudit.

*c..c*, Branchias ſuſpicatus ſum (vulgo barbam) oſtrei; colore ex cinereo albicante, & ſua ſubſtantia læviſſima a colore & materia lapidis ſeſe diſtinguentes, coadunatis ſcilicet particulis reſolutis branchialibus cum terreis particulis ſubtiliſſimis, & ſucceſſu temporis petrificantibus, quaſi in magmate ſuperſtites; idque eo fidentius credidi, quo facilius branchiæ teſtaceorum naturales pariter a reliquis partibus mollibus colore & ſubſtantia diſtinguuntur.

Fig. 2. Superior valva eſt, vel concha magis convexo-concava, quam ſuperior valva oſtrei in cœnis noti; ubi rurſus

*a*, *a*, Ginglymi, &

*b*, Tendo, antagoniſta, apparent.

Fig. 3. Prototypum dixeris animalculi, poſt branchias integri, pariter ac branchiæ immutatum, & in cavitate valvarum repertum; in quo litera

*a*, cernere licet veſtigium proceſſus tendinoſi a parte teſtæ convexo-concavæ:

*b*, vero proceſſum valvæ complanatæ oppoſitum.

Sic ſalva manſit forma animalis, tota vero ſubſtantia abiit in materiam lutoſam, induratam, lævem;

Et id forſan eſt, quod Le Bruyn dicere voluit, verbis; " Au milieu . . . on voit l'huitre entiere, et en " méme tems, comment elle paroit gravée dans " l'autre écaille."

Fig. 4. Reliquum diconchæ; ex quo apparet, teſtam fuiſſe minus ponderoſam teſta oſtrei vulgaris; lævem; non imbricatam neque ſulcatam.

Cæterum omnibus notum eſt, quod in plurimorum oſtreorum interna, inprimis concavæ valvæ pariete, ſit velut ciſterna, aquam cum voluptate appeti ſolitam continens, tenui lamella teſtacea clauſa, & a cardine plerumque integrum animalis thalamum adæquans; hanc ciſternam, cum a ſolida teſta mox diſtinguitur, imperitos fallere, experientia me docuit. Nam plus una vice contigit, quod hic vel ille in conchis foſſilibus cavitatem tranſparenti laminula opertam imaginarie pronuntiaverit; oſtrei figuram teſtæ alterutri ruditer inſcriptam.

Forſan vel ſimilis teſta foſſilis monticuli Nicoſiani Bruynio impoſuit, “Que l'huitre a imprimé ſa forme “dans l'écaille,” audacter ad figuram, quam dedit, provocanti; “comme on le peut voir dans la figure;” cum tamen ipſa figura, paulo attentius conſiderata, nihil aliud oculis offert, quam ſimplicem teſtam, vix umbratilem, difformem potius vel imaginariam oſtrei ſpeciem formamve mentientem. Hoc aſſertum multis ſchematibus probare poſſem, ſed unicum ſufficiat:

Fig 5. Oſtrei peregrini & polyginglymi, montis Zigarorum. Ecquis autem nobis perſuadere præſumeret, circumſcriptam literis *a*; *b*; *c*; *d*; *e*; figuram eſſe formam, quam animal moribundum teſtæ ſuæ impreſſit? cum in oculos incurrat, denotare ciſternam ſupraſatam, non niſi particula dictæ lamellæ teſtaceæ tenuis, e regione literæ *b*, ſuperſtite.

# VI. *Obſervationes* Martis, *Autumno Anni* 1736. Berolini *habitæ, a* Chriſtfr. Kirch, Regiæ Societatis *ibidem Aſtronomo.*

## I.
## *Conjunctio Martis & μ ♓.*

I. Diebus 10, 11 & 12 Octobris, cum ♂ prope μ ♓, ſtellam 5 magnitudinis tranſiret, ſequentes obſervari diſtantias centri Martis a dicta ſtella.

| Stylo novo. | Temp. vero. | | | Partes Microm. | Valor p. Micr. |
|---|---|---|---|---|---|
| | H. ′ | | | | ′ ″ |
| D. 10 Octobr. | 9. 41. veſp. | ♂ μ ♓ | Tub. 7 ped. | [illegible] | 19. [illegible] |
| | 9. 46. | . . | Tub. 9 ped. | [illegible] | [illegible] |
| D. 11 Octobr. | 10. 1. | ♂ μ ♓ | Tub. 9 ped. | 22½ | [illegible] |
| | 10. 4. | . . | Tub. 7 ped. | 16 | 6. [illegible] |
| | 10. 9. | . . | Tub. 7 ped. | 16½ | 6. 3[illegible] |
| | 10. 12. | . . | Tub. 9 ped. | 22 | 6. 33. |
| D. 12 Octobr. | 8. 55. veſp. | ♂ μ ♓ | Tub. 9 ped. | 71½ | 21. 18. |
| | 8. 59. | . . | Tub. 7 ped. | 53 | 21. 12. |
| | 9. 5. | . . | Tub. 7 ped. | 53½ | 21. 24. |

II. Ut ex his diſtantiis obſervatis eruerem Tempus conjunctionis Martis cum ſtella μ ♓, elegi 3 diſtantias ſequentes.

| | H. ′ | | ′ ″ |
|---|---|---|---|
| 1. D. 10. Octobr. | 9. 43. | veſp. diſt. centri ♂ a μ ♓ | 19. 22. |
| 2. D. 11. Octobr. | 10. 6. | veſp. . . . . | 6. 34. |
| 3. D. 12. Octobr. | 9. 0. | veſp. . . . . | 21. 18. |

Et

Et ex ephemeridibus ſuppoſui motum diurnum Martis in longitudine 19′ 30″, in latitudine 3′ 40″: eſt itaque motus diurnus Martis in orbita propria 19′ 51″, & angulus orbitæ Martis & eclipticæ (ſeu potius cum parallelo eclipticæ) 10° 39′.

III. Datis in triangulo obliquangulo $a \mu b$, tribus lateribus, [vid. Fig. I. TAB. IV.] ſcilicet

$ab$, motu Martis, qui competit $24^{h}$. 23′. (ſcilicet tempori inter obſervationem 1 & 2) . . 20′ 10″.
$a \mu$, diſtantia primo obſervata . . . 19 22.
$b \mu$, diſtantia ſecundo obſervata . . 6 34.

Duxi $a \mu$ perpendicularem in orbitam Martis apparentem $\mu \chi$, & in triangulo rectangulo $b \chi \mu$ quæſivi particulam orbitæ Martis, $b \chi$, eamque inveni 1′ 51″.
& diſtantiam minimam ♂ & $\mu$, $\chi \mu$, quam inveni 6 18.
Particulæ orbitæ Martis, $\chi b$, competunt $2^{h}$. 14′
Quæ ſubtracta a tempore 2 obſervationis D. 11. Octobr. . . . } 10 6. veſp.
Relinqunt temp. ver. ☌ ♂ $\mu$ ♓ in orbita D. 11. Octobr. . . . } 7 52. veſp.

IV. In triangulo obliquangulo $b \mu c$, motus Martis inter 2 & 3 obſervationem, $bc$, eſt . . 18′ 55″.
Diſtantia ♂ a $\mu$ ♓ ſecundo obſervata, $b \mu$ 6 34.
Diſtantia ♂ a $\mu$ ♓ tertio obſervata, $c \mu$ . 21 18.

Datis his tribus lateribus quæſivi angulum $c$, eumque inveni 17° 35′. Deinde duxi perpendicularem a $\mu$ in orbitam Martis, $\mu \chi$, & in triangulo rectangulo $c \chi \mu$; data hypotenuſa $c \mu$, quæſivi latera $\mu \chi$, & $c \chi$, & inveni $\mu \chi$, diſtantiam minimam 6′ 26″. & $c \chi$, 20′ 18″.
A quo ſubtractum latus $bc$ . . . . . . . 18 55.
Relinquit $b \chi$ . . . . . . . . . . . 1 23.

Cui competunt in tempore . . . $1^{h}$. 40′.
Quæ ſubtracta a tempore 2 obſervationis 11 Octobr. . . . . } 10 6. veſp.
Dant tempus verum diſtantiæ minimæ, ſive conjunctionis Martis & μ ♓ in orbita 11 Octobr. . . . } 8 26. veſp.

V. Deducta in his duobus proxime antecedentibus paragraphis, ut fieri ſolet, paululum inter ſe differunt. Si motum Martis diurnum quadrante circiter minuti minorem aſſumſiſſem, diſcrepantia foret minor. Interim, ſi ex deductionibus utriſque medium eligo, a veritate vix aut parum aberrare potero. Et ſic colligitur *tempus verum ☌ ♂ μ ♓ in orbita Martis*, 11 *Oct.* $8^{h}$. 9′. *diſtantia minima ♂ a μ ♓* 6′ 22″. *Septentrionalis.*

VI. Quamvis hæc ſufficere mihi potuiſſent, tamen de novo calculum inſtitui, ſupponens motum ♂ diurnum in longitudine . . . . . . . . 19′ 15″.
in latitudine . . . . . . . . 3 40.
Fuit itaque motus ♂ diurnus in orbita . . 19 36.
Et angulus orbitæ Martis cum parallelo eclipticæ 10° 47′ intervalla temporum inter obſervationem 1 & 2, & inter 2 & 3, dato hoc motu Martis diurno in orbita 19′ 36″, dant *ab* 19′ 55″, & *bc* 18′ 42″; diſtantiæ *a*μ, *b*μ, & *c*μ, manent eædem, quæ in ſuperioribus calculis. His datis primo per triangulum *ab*μ, inveni μχ 6′ 22″, & *b*χ 1′ 37″$\frac{1}{2}$.
Quibus reſpondent . . . . . . . $1^{h}$. 59′.
quæ ſubtracta a D. 11 Octobr. 10 6. veſp.
Relinquunt tempus diſtantiæ minimæ D. 11 Octobr. . . . . . . } 8 7. veſp.
Deinde per triangulum *bc*μ, inveni μχ 6′ 21″.

Et

| | |
|---|---|
| Et $b\chi$ 1′ 38″, quibus reſpondent in tempore . . . . . . . . . | 2h. 0′. |
| Quæ ſubtracta a temp. 2 obſervationis D. 11 Octobr. . . . . | 10 6. veſp. |
| Relinquunt tempus diſtantiæ minimæ D. 11 Octobr. . . . . . . . | 8 6. veſp. |

Ut itaque hi calculi optime inter ſe, & cum ſupra electo medio priorum calculorum, conveniant.

VII. Si ex $\mu$ ducitur linea recta $\mu d$, quæ cum linea $\chi\mu$, perpendiculari in orbitam Martis, ad $\mu$ faciat angulum æqualem angulo orbitæ Martis cum parallelo eclipticæ, $d\mu$ erit perpendicularis in eclipticam. Hunc angulum primo deduxi 10° 39′ (§. II.) deinde mutato ſive correcto motu diurno Martis, cum inveni 10° 47′ (§. VI.) In triangulo rectangulo $d\chi\mu$, jam præter angulos notum eſt latus $\chi\mu$ 6′ 22″, & reliqua latera quæruntur. Aſſumto angulo $\chi\mu d$, 10° 39′ latus $\chi d$ eruitur 1′ 12″. Si vero correctiorem angulum adhibeo 10° 47′, illud latus $\chi d$ erit 1′ 13″.

| | |
|---|---|
| Cui competunt in tempore . . . . . | 1h. 29′. |
| Quæ addita ad tempus diſtantiæ minimæ 11 Octobr. . . . . . . . . . . . | 8 7. |
| dant *tempus verum* ☌ ♂ *&* $\mu$ ♓ *in ecliptica* 11 *Octobr.* . . . . . . | 9 36. |

$d\mu$, ſive differentia latitudinis Martis a latitudine ſtellæ in ☌ in ecliptica, eruitur . 6′ 29″.

Quæ ſubtracta a latitudine ſtellæ .. 3° 4 25. Mer.

Relinquit *Latitudinem Martis* . 2 57 56. Mer.

*Longitudo Martis* eſt æqualis longitudini ſtellæ, ſcilicet ex accuratiſſimo *ſtellarum inerrantium catalogo Britannico* . . . . . . . . . . . . ♈. 19° 25′ 40″.

VIII. Ad tempus conjunctionis Martis & μ ♓ in ecliptica, ſcilicet Berolini, tem. vero. 11 Oct. $9^h$. 36″.
Et Bononiæ tempore medio . . 11 Oct. 9 14.
Ex ephemeridibus Cel. Manfredii eruitur longitudo Martis . } ♈. 19° 14′ 40″.
Quæ deficit ab obſervatione . . . . . . 11 0.
Ephemerides Ghiſlerii dant longit. ♂ ♈. 19° 4′ —
22 fere minutis ab obſervatione deficientem, & ephemer. Dni. Deſplaces } ♈. 19 25 —
Obſervationi ſatis congruam.

Manfredianæ ephemerides dant latitudinem Martis meridionalem . . . . . . . . . . 2° 57′. —
Id eſt; 1 minuto fere minorem latitudine obſervata; ex ephemeridibus Ghiſlerianis illa colligitur . 2° 57′½.
& ex Deſplaces ephemeribus . . . . . 2 59½.

## II.

## *Locus Martis in oppoſitione Solis.*

I. Tempore conjunctionis Martis & μ ♓ in ecliptica, ex Manfredianis ephemeribus eruitur locus Solis . . . . . . . . . . . 6 ♎ 18° 46′ 21″.
Quo tempore longitudo Martis fuit 0 ♈ 19 25 40.
Itaque ♂ fere fuit in oppoſitione Solis, & tantum 39′ 19″. abfuit a loco Soli oppoſito.
Motus diurnus Solis fuit . . . . . 0° 59′ 34″.
Et Martis retrogradi motus diurn. in eclipt. 19 15.
Summa dat motum ☉ a ♂ diurnum . 1 18 49.

II. Ut 1° 18′ 49″. motus diurnus ☉ a ♂, ad 24 horas, ita 39′ 19″ diſtantia ♂ ab oppoſito Solis ad $11^h$ 58′.
Quæ addita ad tempus verum ☌ ♂ μ ♓ in eclipticâ 11 Octobr. . . . . . . } 9 36.

Dant *tempus oppoſitionis Martis & Solis Berolini, tempore vero* 11 *Oct.* . } $21^{h}$ 34'.
Æquatio temporis ſubtrahatur . . . $13\frac{1}{2}$.
Et reſtabit tempus medium Berolini 11 Oct. 21 $20\frac{1}{2}$.
Pro differentia meridianorum inter Bononiam & Berolinum ſubtrahe . } $8\frac{1}{2}$.
Reſtat tempus medium Bononiæ 11 Oct. 21 12.

III. Ut 24 horæ ad 19' 15" motum diurnum Martis in longitudine, ita $11^{h}$. 58'. tempus inter ☌ ♂ & μ ♓ in ecliptica & oppoſitionem ☉ & ♂, ad 0° 9' 36".
Quæ ſubtracta a Long. ♂ in ☌ ♂ & μ ♓ 0 ♈ 19 25 40.
Relinquunt *Longitud. ♂ in ☍ ☉* . 0 ♈ 19 16 4.
*Locus Solis* ex ephemeridibus Manfredianis
D. 11. Oct. $21^{h}$. 12'. tempus medium Bononiæ eruitur . . } 6 ♎ 19 16 3.

Differentia tantum unius minuti ſecundi (præter ſemicirculum) a loco Martis, quæ tuto negligitur.

VI. Ut 24 horæ ad 3' 40", motum diurnum Martis in latitudine, ita $11^{h}$. 58' ad . 0° 1' 50".
Quæ ſubtracta a Latitudine Martis
In conjunctione ♂ & μ ♓ in ecliptica 2 57 56 Mer.
Relinquunt *Latitudinem ♂ in ☍ ☉* 2 56 6 Mer.

## III.

## *Obſervationes Martis circa ſtationem ejus ſecundam, menſe* Novembri, *ann.* 1736.

Verſabatur Mars inter ſtellas *e*, ε & ζ Piſcium, aliaſque ſtellas minores; a quibus diſtantias Martis ſæpius dimenſus ſum, tribus diverſis tubis, ſcilicet tubo 7, tubo 9, & tubo 2 pedum, ſemel etiam tubo 18 pedum. Per tubos longiores diſtantiæ accuratiores capi poſſunt: quia vero ſpatium non adeo magnum ſimul comprehendunt, minores tantum diſtantias per ipſos dimetiri potui. Per tubum 2 pedum majores quidem diſtantiæ obſervari potuerunt; illæ tamen non adeo accuratæ eſſe ſolent, quin aliquando dubium 1 vel 2 minutorum irrepere poſſit, præſertim ſi diſtantiæ nimis magnæ ſunt, ut capacitatem tubi fere expleant. Tales errores maxime ſe produnt, quando ſitus ſtellarum in chartam delineatur, & diſtantiæ planetæ a diverſis ſtellis, non in uno puncto, ſe interſecant. Excerpſi ſtellas, a quibus Martem dimenſus ſum, ex catalogo Britannico, & per diſtantias Martis ab his ſtellis, locum planetæ ope circini indagavi. Primo enarrabo diſtantias captas; deinde exhibebo loca Martis per illas eruta. Ubi notandum eſt, me delineatione uſum fuiſſe, in qua magnitudines graduum, & diſtantiæ ſtellarum, duplæ fuerunt earum, quas ſchema adjectum exhibet. [Vid. Fig. 2. Tab. IV.]

| Stylo novo. | Temp. vero veſperi. | | | Partes Microm. | Valor parium Microm. |
|---|---|---|---|---|---|
| | H. ′ | | | | ° ′ ″ |
| D. 27 Oct. | 8. 58. | ♂ e ♓ | Tub. 7 ped. | 121. | 0. 48. 24. |
| D. 29 Oct. | 8. 30 | ♂ e ♓ | Tub. 7 ped. | 6. | 24. 48. |
| | 8. 38. | . . | Tub. 9 ped. | 83. | 24. 43. |
| D. 1 Nov. | 11. 6. | ♂ e ♓ | Tub. 9 ped. | 38. | 11. 18. |
| | 11 10. | . . | Tub. 7 ped. | 28. | 11. 12. |
| D. 5 Nov. | 7 22. | ♂ a. | Tub. 7 ped. | 34½. | 13. 48. |
| | 7. 26. | ♂ e ♓ | . . . | 100½. | 40. 12. |
| | 8. 14. | ♂ c. | . . . | 105. | 42. 0. |
| | 8. 21. | ♂ a. | Tub. 9 ped. | 44. | 13. 6. |
| D. 6 Nov. | 7. 28. | ♂ a. | Tub. 7 ped | 17. | 6. 48. |
| | 7. 34. | ♂ e ♓ | . . . | 116. | 46. 24. |
| | 7. 40. | ♂ c. | . . . | 110. | 44. 0. |
| | | vel. | | 110½. | 44. 12. |
| | 7. 44. | ♂ a | Tub. 9 ped. | 23½. | 6. 59. |

| Stylo novo. | Temp. vero veſperi. | | | Partes Micro. | Valor partium Microm. |
|---|---|---|---|---|---|
| | H. ' | | | | ° ' " |
| D. 7 Nov. | 6. 4. | ♂ α. | Tub. 18 ped. | 16. | 2. 17. |
| | 7. 47. | ♂ α diſtin. | Tub. 7 ped. | 5½. | 2. 12. |
| | 7. 50. | ♂ e ♓ | . . . | 129. | 51. 36. |
| | 7. 53. | ♂ c. | . . . | 118. | 47. 12. |
| D. 12 Nov. | 9. 19. | ♂ α. | Tub. 7 ped. | 52. | 0. 20. 48. |
| | 9. 27. | ♂ e ♓ | . . . | 172. | 1. 8. 48. |
| | 9. 38. | ♂ c. | . . . | 165. | 1. 6. 0. |
| D. 13 Nov. | 7. 32. | ♂ α. | Tub. 9 ped. | 77. | 0. 22. 56 |
| | 7. 36. | ♂ α. | Tub. 7 ped. | 58. | 0. 23. 12. |
| | 7. 40. | ♂ e ♓. | . . . | 175. | 1. 10. 0. |
| | 7. 44. | ♂ c. | . . . | 171. | 1. 8. 24. |
| D. 15 Nov. | 7. 2. | ♂ α. | Tub. 7 ped. | 72. | 0. 28. 48. |
| | 7. 9. | ♂ e ♓. | . . . | 179. | 1. 11. 36. |
| | 7. 13. | ♂ c. | . . . | 186½. | 1. 14. 36. |
| | 7. 18. | ♂ α. | Tub. 9 ped. | 96. | 0. 28. 35. |
| D. 26 Nov. | 6. 11. | ♂ c ♓. | Tub. 2 ped. | 91. | 1. 22. 6. |
| | | ♂ ζ ♓. | . . . | 106. | 1. 35. 38. |
| | | ♂ δ ♓. | . . . | 94. | 1. 24. 48. |
| | | ♂ c. | . . . | 143. | 2. 9. 2. |
| | | ♂ α. | . . ♓. | 113. | 1. 41. 57. |
| | | ♂ e ♓. | . . . | 92. | 1. 23. 0. |
| | 6. 32. | ♂ α. | . . . | 103. | 1. 32. 55. |
| D. 28 Nov. | 6. 43. | ♂ ζ ♓. | Tub. 2 ped. | 104. | 1. 33. 50. |
| | 6. 46. | ♂ ζ ♓. | . . . | 82. | 1. 12. 59. |
| | 9. 34. | ♂ δ ♓. | . . . | 103. | 1. 32. 55. |
| | 9. 37. | ♂ e ♓. | . . . | 105. | 1. 34. 44. |
| | 9. 41. | ♂ ζ ♓. | . . . | 82. | 1. 13. 59. |
| | | medium. | | 81. | 1. 13. 5. |
| D. 3. Dec. | 9. 41. | ♂ e ♓. | Tub. 2 ped. | 160. | 2. 24. 23. |
| | | ♂ δ ♓. | . . . | 157. | 2. 21. 40. |
| | 9. 52. | ♂ ζ ♓ | Tub. 7 ped. | 56. | 0. 22. 24. |
| | 10. 1. | ♂ ζ ♓. | Tub. 9 ped. | 73½. | 22. 29. |
| | | vel. | | 75. | 22. 38. |
| D. 6. Dec. | 5. 33. | ♂ δ ♓. | Tub. 2 ped. | 201. | 3. 1. 22. |
| | 5. 39. | ♂ e ♓. | . . . | 204. | 3. 4. 4. |
| | 5. 44. | ♂ ζ ♓. | . . . | 50. | 0. 45. 8. |
| | | ♂ ζ ♓. | Tub. 7 ped. | 113½. | 0. 45. 24. |
| | 5. 57. | ♂ ζ ♓. | Tub. 9 ped. | 153. | 0. 45. 34. |

Hæ diſtantiæ ſemper a centro Martis intelligendæ ſunt, præſertim per tubos longiores.

Sequuntur loca Martis, ex diſtantiis recenſitis deducta, & loca ejuſdem ex diverſis ephemeridibus excerpta, ut conſenſus ſive diſſenſus appareat inter calculos & obſervationem.

| Stylo novo. | T. ver. veſperi. | | Longitudo Martis. | Latitudo Martis. |
|---|---|---|---|---|
| | H. ′. | | ° ′ ″. | ° ′ ″. |
| D. 5 Nov. | 8. 18. | Obſervatio | ♈ 13. 37. 0. | 1. 17. 0. M. |
| | | Manfredii. | 13. 26. — | 1. 16. 30. |
| | | Ghiſlerii. | 13. 42. — | 1. 20. 30. |
| | | Deſplaces. | 13. 35. 30. | 1. 17. 30. |
| D. 6 Nov. | 7. 26. | Obſervatio | ♈ 13. 32. 0. | 1. 13. 15. M. |
| | | Manfredii. | 13. 22. — | 1. 13. — |
| | | Ghiſlerii. | 13. 37. 30. | 1. 16. — |
| | | Deſplaces. | 13. 31. — | 1. 14. — |
| D. 7 Nov. | 7. 50. | Obſervatio | ♈ 13. 27. 40. | 1. 9. 30 M. |
| | | Manfredii. | 13. 17. 40. | 1. 9. 20. |
| | | Ghiſlerii. | 13. 32. 40. | 1. 12. — |
| | | Deſplaces. | 13. 27. — | 1. 10. — |
| D. 12 Nov. | 9. 28. | Obſervatio | ♈ 13. 20. 0. | 0. 50. 40. M. |
| | | Manfredii. | 13. 8. — | 0. 51. — |
| | | Ghiſlerii. | 13. 19. 30. | 0. 53 — |
| | | Deſplaces. | 13. 18. — | 0. 51. 30. |
| D. 13 Nov. | 7. 38. | Obſervatio | ♈ 13. 20. 30. | 0. 48. 0. M. |
| | | Manfredii. | 13. 9. 15. | 0. 48. — |
| | | Ghiſlerii. | 13. 19. — | 0. 49. 30. |
| | | Deſplaces. | 13. 19. — | 0. 48. — |
| D. 15 Nov. | 7. 12. | Obſervatio | ♈ 13. 23. 30. | 0. 42. 0. M. |
| | | Manfredii. | 13. 13. — | 0. 41. — |
| | | Ghiſlerii. | 13. 21. 30. | 0. 43. — |
| | | Deſplaces. | 13. 21. 30. | 0. 41. — |
| D. 26 Nov. | 6. 20. | Obſervatio | ♈ 14. 35. 0. | 0. 9. 0. M. |
| | | Manfredii. | 14. 26. — | 0. 9. — |
| | | Ghiſlerii. | 14. 37. — | 0. 12. — |
| | | Deſplaces. | 14. 34. — | 0. 9. 30. M. |

| Stylo novo. | T. ver. veſperi. | | Longitudo Martis. | | | | Latitudo Martis. | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | H. ′. | | | ° | ′ | ″ | ° | ′ | ″ | |
| D. 28 Nov. | 9. 35. | Obſervatio | ♈ | 14. | 57. | 0. | 0. | 3. | 30. | M. |
| | | Manfredii. | | 14. | 49. | 30. | 0. | 4. | — | M. |
| | | Ghiſlerii. | | 14. | 59. | — | 0. | 7. | — | M. |
| | | Deſplaces. | | 14. | 57. | 30. | 0. | 5. | — | M. |
| D. 3 Dec. | 9. 48. | Obſervatio | ♈ | 16. | 1. | 0. | 0. | 6. | 30. | S. |
| | | Manfredii. | | 15. | 57. | — | 0. | 7. | 40. | S. |
| | | Ghiſlerii. | | 16. | 3. | — | 0. | 5. | — | S. |
| | | Deſplaces. | | 16. | 2. | — | 0. | 7. | — | S. |
| D. 6 Dec. | 5. 46. | Obſervatio | ♈ | 16. | 46. | — | 0. | 16. | — | S. |
| | | Manfredii. | | 16. | 40. | 30. | 3. | 13. | 30. | |
| | | Ghiſlerii. | | 16. | 47. | 30. | 0. | 10. | 30. | |
| | | Deſplaces. | | 16. | 50. | 33. | 0. | 13. | 30. | S. |

Duobus ultimis diebus, ſcilicet 3. & præſertim 6 Decembris, loca Martis, ex obſervatione deducta, ſunt incerta: Illa itaque, ſi cui ita viſum fuerit, plane omitti poſſunt.

Loca ſtellarum fixarum in ſchemate adjecto, ex catalogo Britannico ad initium anni 1690. ſine ulla reductione excerpta ſunt: quare longitudinibus Martis, quas figura nobis exhibuit, 39′ 0″, vel 39′ 5″, addenda fuerunt, pro motu ſtellarum fixarum in 46 annis, & 10 vel 11 circiter menſibus.

Omiſſæ ſunt ſupra obſervationes diei 9 Novembr. quas hic adjiciam, cum loco Martis ex illis deducto.

| Stylo novo. | Temp. vero veſperi. | | | Partes Micro. | Valor partium Microm. |
|---|---|---|---|---|---|
| | H. ′. | | | | |
| D. 9 Nov. | 9. 28. | ♂ a. | Tub. 7 ped. | 25. | 0. 10. 0. |
| | 9. 30. | ♂ e ♓ | . . . | 152. | 1. 0. 48. |
| | 9. 34. | ♂ c. | . . . | 136. | 0. 54. 24. |
| | 9. 41. | ♂ a. | Tub. 9 ped. | 32½. | 0. 9. 40. |

| Stylo novo. | Temp. vero veſperi. | | Longitudo Martis. | Latitudo Martis. |
|---|---|---|---|---|
| | | | ° ′ ″ | ° ′ ″ |
| D. 9 Nov. | 9. 34. | Obſervatio<br>Manfredii. | ♈ 13. 22. 20. | 1. 1. 30. M. |
| | | | 13. 22. — | 1. 0. 30. |
| | | Ghiſlerii. | 13. 11. — | 1. 3. 30. |
| | | Deſplaces. | 13. 25. — | 1. 2. 30. |

# VII. *A Collection of the* Obſervations *of the Remarkable* Red Lights *ſeen in the Air on* Dec. 5. 1737. *ſent from different Places to the* ROYAL SOCIETY.

## 1. *An Account of the* Red Lights, *on* Dec. $\frac{5}{16}$. 1737. *as obſerved* (*at* Naples) *by the Prince of* Caſſano, F. R. S. *and by him ſent in a Letter to the* Preſident: *Tranſlated from the* Italian *by* T. S. *M. D.* F. R. S.

A *Phænomenon* of a fiery Meteor is my Motive for troubling you, Sir, with this other ſhort Narrative; being perſuaded that it will be as agreeable to you to peruſe, as it was to me to draw it up with all the Circumſtances of Truth, to which I was an Eye-witneſs.

*Dec.* 16. 1737. (*N. S.*) in the Evening, the Sun being about 25 Degrees below the Horizon, a Light was obſerved in the North, as if the Air was on Fire, and flaſhing; the Intenſeneſs of which gradually increaſing, at the Third Hour of the Night it ſpread Weſtward in ſuch a Manner, that if a Perpendicular was let fall from the Polar Star, and afterwards a

Parallel to the Horizon ſuppoſed, and divided into Six equal Parts, which Parallel ſhould paſs through the whole Extent of the aforeſaid Light, it is certain, that Five Parts of the Six would be towards the Weſt, and only One toward the Eaſt.

The greateſt Height of this Light was about 65 Degrees; for it occupied the whole Extent of both the *Bears*, and the *Polar Star*: Yet at the Sides it was not ſo high; for in ſome Places near the North it aroſe only to 50 Degrees; and gradually diminiſhed, ſo as to become inſenſible at the true Horizon.

The above-mentioned Light at its Extremities was unequally jagged, and ſcattered, and followed the Courſe of the Weſterly Wind; ſo that for a few Hours it ſpread conſiderably wider, yet without ever reaching the *Zenith*.

The greateſt Redneſs and Inflammation appeared half Way, between the viſible Pole and the Northern Point of the Horizon; and in the Middle of this inflamed Part there appeared ſome Streaks leſs inflamed, and moſtly perpendicular to the Horizon; ſome of which flaſhed from time to time, while others ſucceſſively vaniſhed. About the Sixth Hour of the Night the Intenſeneſs of the Colour diſappeared; ſome ſmall Traces of the Inflammation ſtill remaining towards the North-eaſt and the Weſt, which were all vaniſhed at $7^{h}$. ½ (of the Night.)

During the greateſt Vigour of the Inflammation, ſome ſmall dark Clouds often croſſed the Light parallel to the Horizon: But the Sky was very clear, except in ſome Parts near the Horizon, where it was much overcaſt with Clouds.

The inflamed Matter, in the greateſt Part of its Extent, gave a free Paſſage to the Rays of the Stars, even of the Third and Fourth Magnitude, ſituate behind it. About the Fourth Hour of the Night, a very regular Arch of a parabolic Figure was ſeen to riſe gently, to Two Degrees of rectangular Elevation, and to Twenty Degrees of horizontal Amplitude.

This *Phænomenon* was ſeen all over *Italy*, as appears by ſeveral Accounts of it, though with ſome Diſagreement between them.

But how bright ſoever and diſtinct it appeared, yet it's Cauſe has been deemed by many to be very obſcure: For ſome call it an *Aurora Borealis*, therein following the Opinion of *Gaſſendus*, and deducing all the Appearances from the Laws of ſimple Refraction of the ſolar Rays. Others think it an Irradiation of ſome luminous Comet, placed below our Horizon. Others more politely ſay, it was a new celeſtial Body deſcended from its upper Habitation down to us, and courteouſly received by the Earth's *Vertex*. Others, in Love with Authority, and *French* Names, have endeavoured to eſtabliſh the Meteor as a Mixture of the Two Atmoſpheres of the Sun and Earth; therein tenaciouſly adhering to the new Opinion of Monſieur *de Mairan*, of the *Academy of Sciences* at *Paris*. In fine, others more accurately deduce the Whole from the ſimple Firing of a bituminous and ſulphureous Matter, upon account of its very little ſpecific Gravity, raiſed to the upper Parts of the Atmoſphere, and there, by the Claſhing of contrary Winds, broken, comminuted, and at laſt ſet on Fire. This Opinion has been defended with ſtrong Arguments, in the *Petersburg* Commentaries, by *Mayerus*, upon Occaſion of the Appearance of a ſimilar *Phænomenon* in thoſe Northern Countries.

And, indeed, the preceding Eruption of *Veſuvius*, the Contrariety of the moving Forces, the Readineſs of the Matter to take Fire, the unequal Intenſeneſs of the Light, the Streaks, and all the other Circumſtances, obſerved in this Meteor, are plain Arguments of a genuine and real Accenſion. And *Wolfius*, on the Appearance of a *Phænomenon* much like this, which was ſeen all over *Germany* on the 17th of *March* 1717. is of Opinion, that it ſhould be called imperfect Lightning, as being produced by the inflammable Matter of Lightning: And poſſibly we ſhall ſee the ſubſequent Rains fall quietly, without Lightning or Thunder.

1*ſt*, That it could be a Refraction, happens to be diametrically contrary to the Laws of Refraction; becauſe the Sun was then in the oppoſite Tropic.

2*dly*, The Light ought to have been moſt intenſe in the Eaſt, and weak in its Elevation; whereas quite the contrary was ſeen to happen. Thus the Whole is accounted for, not by Dioptrics, but by the ſole Laws of direct or reflex Viſion; and the Streaks, already taken notice of, were Spaces containing leſs of the inflammable Matter; whereby the luminous Rays of the neighbouring kindled Matter, being weakly reflected, made the Appearance of a fainter Colour.

3*dly*, The uneven Appearance of the Light at its Extremities cannot be accounted for by Refraction, but perfectly well by Accenſion: Wherefore I think it rather deſerves the Name of a *Northern Light* or *Fire*, than that of an *Aurora*: But I leave the further Conſideration thereof to better Heads.

## 2. *An Account of an* Aurora Borealis *obſerved in the Night of the 16th of* December 1737. *(N. S.) at* Padua, *by [the Marquis]* Poleni, F. R. S. *Communicated in a Letter to Dr.* Jurin: *Tranſlated from the* Latin *by* T. S. *M. D.* F. R. S.

THE Sky was intirely clear, not only in the Beginning, but during the whole Night. The Wind was at North; which was rather known by the Weather-cock, than ſenſibly felt, the Air being very ſtill. The Quickſilver in the Barometer ſtood at 30 Dig. 24 Dec. (*Engliſh* Meaſure) an extraordinary Height; ſince in the Space of 14 Years, that I have applied with great Care to Meteorological Obſervations, I have but once obſerved the Quickſilver at 30. 48. which I have hitherto looked upon as the greateſt Height.

In my Thermometer of Monſieur *Amonton*'s Make, the Height of the Quickſilver was 48 Dig. 78 Dec. And in Monſieur *de l'Iſle*'s Thermometer, which he ſent me from *Petersburg*, (in which the Heights are changed by the greater or leſſer Denſity of the Mercury, and the Meaſure is taken behind the vacant Space at Top) I reckoned 142.

But before I treat of the Obſervation, it becomes neceſſary to remark Two Things, *viz.* that I ſuppoſe, that the Diviſions of the Horizon into Degrees Eaſtward and Weſtward begin from that Point, where the Meridian interſects the Horizon in the North: And beſides, when I mention the Degrees of the Horizon, or Degrees only, I mean thoſe Diſtances

which

which can be defined by the vertical Circles reaching to the Degrees mentioned.

In ſetting down my Obſervations, I made uſe of apparent Time (*p. m.*) Afternoon.

At $5^{h}.\frac{1}{4}$, there appeared near the Horizon a blackiſh Zone, with its upper Limb of a Sky-colour, ſomewhat obſcure. Above this Zone was another very luminous, reſembling the Dawn pretty far advanced. The higheſt Zone was of a red firy Colour. The Altitudes of the Zones ſeemed to bear ſuch Proportion, that the Second was double the Firſt, and the Third triple: And, at the ſame time, they in many Places roſe ſomewhat above the 40th Degree of Altitude. Eaſtward they extended to the 55th Degree on the Horizon, and Weſtward to the 70th. They had Three perpendicular ſlender Diviſions, like Slits; but they were parallel to the Horizon, excepting that the Third had ſome Parts of its upper Limb unequal in Height, with ſome Aſperities upon it; and from the Firſt to the Sixth Degree Weſtward, a ſort of Beam wider than the reſt was obſerved. The Stars of Part of the *Great Bear*, the *Dragon*, *Hercules*, and others, appeared more or leſs through the *Phænomenon* (and others afterwards, according as the Appearances varied). But through the lower Zone they appeared more obſcurely, and in ſome Places not at all: Through the middle Zone, they ſhone bright; but through the higheſt, they were leſs diſtinct.

I cannot determine with Certainty the firſt Moment of the Appearance of this *Aurora*: Nor indeed does it ſeem feaſable, to define the Riſe of ſuch *Phænomena* with ſufficient Accuracy. But it is worthy of Remark, that after Sun-ſet on the preceding Days, as well as this, there appeared in the Weſt a remarkable Redneſs expanded on each Side: And moreover, on the enſuing Evening, the ſame bright red Colour, appearing near the Horizon, deceived the common People into a Belief, that a new *Phænomenon*, like the foregoing, was breaking out of the Horizon. Wherefore I am of Opinion, that in this Caſe there is a conſiderable Difference between the *Aurora Borealis*, and the Redneſs occaſioned by the Sun's ſetting.

About Three-quarters of an Hour after, the Length of the Zones was contracted, their Extremities having receded about Ten Degrees from the Eaſt and Weſt. The white lucid Part was not now ſo diſtinguiſhable from the red, as before: And this laſt Colour grew fainter almoſt every-where elſe but at the Weſtern Limit, where it was more vivid: But in that Weſtern Space from which the *Aurora* was withdrawn, there remained a brighter Space of Three or Four Degrees, ſurrounded by a ſmall black Cloud, ſo that it ſeemed to be a kind of *Hiatus*. Near our *Zenith* there appeared ſome thin lucid Clouds, partly of a Whitiſh-red, in ſuch a manner, that they ſeemed as if occaſioned by the burning of Houſes at ſome Diſtance to the North. Others of this ſort had happened before, and ſome were ſeen afterwards.

A little after Six, the upper Parts began to emit red Streamings, or Rays, in Plenty; but in theſe the Red was now-and-then intermixed with whitiſh and darkiſh Colours.

In a few Seconds after, there iſſued forth from the very Æquinoctial Weſt, a red and very bright Column,

lumn, which aſcended to the Third Part of the Heavens; and a little after, it became curved in the Shape of the Rainbow.

At Three-quarters after Six, the red Colour appeared fainter, and the Zones were not ſo diſtinct from one another; the *Phænomenon* reached only to the 20th Degree Eaſt, but to the Weſt it retained its Length, as before.

At Seven, the *Phænomenon* appeared interrupted, and divided into Two Parts, the intermediate Space becoming almoſt inviſible. The red Part of its Weſtern Extremity was curved into an Arch terminating near the Horizon. Not far from the 84th Degree to the Weſt, there appeared a ſort of *Hiatus*, not unlike that in the Eaſt already deſcribed, and which had vaniſhed by this time.

Seven Hours 20 Minutes, the whole *Aurora* was become paler, ſo that the red Colour was ſcarce diſcernible, except at the Weſtern End, where it was of the Colour of Fire.

A little after Eight, the lowermoſt of the Zones, as they now ſtood, was blackiſh; and above this another whitiſh bright one was ſeen: And ſome Parts of theſe ſeemed to fluctuate, and be agitated (as it often happened before and after); and, if any of them diſappeared, they were ſoon ſucceeded by others.

At half an Hour after Eight, almoſt in an Inſtant of Time, the bright Zone, from the 8th Degree Weſt to the 50th Eaſt, became more vivid, and roſe higher; and above this appeared a new large one, of a red firy Colour, with ſeveral ſucceſſive Streamings tending upward, and paſſing 60 Degrees of Altitude:

tude: The Weſtern Part had aſſumed the Form of a thin Cloud.

A little before Nine, at 16 Degrees Eaſtward, a curved red Beam, (or Bow) though irregular in ſome of its Parts, roſe up to the *Zenith*; and at the ſame time ſuch another, commencing at the Horizon beyond the 80th Degree Weſt, aroſe to the ſame Height, and joined the Eaſtern Arch in the *Zenith*.

At Nine, after theſe Beams had been up to the *Zenith* a very ſhort time, they parted, and began to fall conſiderably lower: But in that Place where they were in Contact, there remained a certain reddiſh Cloud, which gradually changed in Magnitude and Figure: However, I never obſerved it to aſſume that Figure which might properly be called a *Corona*. In ſome time it vaniſhed, as the other Appearances did from the *Zenith*: Nay, the whole *Phænomenon* grew leſs, and fainter; and was reduced to the irregular Form of bright Clouds and Beams, whoſe Light ſtill diminiſhed.

At Three-quarters after Nine, the Weſtern Part was transformed into the Appearance of one Cloud, of a very red Colour, with very little Roughneſſes on its Edges; but it was ſomewhat more contracted than before.

A little after Ten, the Heavens became brighter from the 84th Degree Weſt, to the 18th Degree Eaſtward, and to 50 Degrees high, or better.

At 10h. 36′. the *Phænomenon* was contracted, being now about Ten Degrees in Longitude ſhorter on each Side. But its upper Part was very red, as if on Fire, with ſeveral Rods, or narrow Beams, ſhooting from it. In a word, the Diſpoſition and Brightneſs of its Parts came very near the Shape and Vigour the *Phænomenon* had at the Beginning.

At Eleven, the red Part did not afford the Sight of theſe Rods and Dartings; and the Colour being now fainter and pale, the whole *Aurora* was divided into Two Parts, and the Light was weaker.

In Ten Minutes after, the intermediate Sciſſure was larger, being now near 20 Degrees; and the Part on the Right Hand ran ſomewhat Eaſt.

About 10$^{\text{h}}$. ½, the Redneſs became ſtronger, but more ſo to the Weſt than to the oppoſite Part.

In a Quarter of an Hour, both the Light and Redneſs diminiſhed; ſo that the only Space that retained a vivid Light was that of Six Degrees to the Weſt.

At Twelve, the Light of the *Aurora* was nearly extinct, there appearing only a very weak Light along the Tops of the Mountains.

Twenty Minutes after, there appeared a white brightiſh Beam, at 30 Degrees Weſt, and 60 Degrees high; but it ſoon became inviſible.

In half an Hour after, a very weak Light remained in the Weſt, near the Horizon; which had not been obſervable, if the Brightneſs of the preceding *Phænomenon* had not invited me to continue the Obſervation.

At a Quarter after One, that weak Light was much contracted.

The Tranquillity of the Air continued the ſame, or nearly ſuch, as in the Beginning; and yet there was not the leaſt Report, or even hiſſing Noiſe, heard to iſſue from ſo much Matter.

At 1h. 30′. that Part of the Heavens where the *Aurora Borealis* had ſhone forth, was no ways different from the reſt; and the only Light in the Sky proceeded from the Stars, and the Moon, which was now up.

I had at other times obſerved ſome luminous Appearances in the Heavens, which may be referred, in ſome meaſure, to the Claſs of the *Phænomenon* above deſcribed; but I was of Opinion, that the Memory of this ought to be preſerved with the greater Diligence, as it far ſurpaſſed all that preceded it in Magnitude, Light, Figure, Colours, and Duration.

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## 3. *Deſcription of an* Aurora Borealis *obſerved at the Obſervatory of the* Inſtitute *of* Bononia, *the Night of the* $\frac{5}{16}$ *of* December 1737. *By Dr.* Euſtachio Zanotti, *Deputy Profeſſor of Aſtronomy. Tranſlated from the* Italian *by* T. S. *M. D.* F. R. S.

THE *Aurora Borealis*, which was formerly a rare *Phænomenon*, and almoſt unknown in this our Climate, is now become very frequent. In *Bononia* a great Number have been obſerved for ſome Years paſt, as appears by the Regiſter of the Obſervations made in this *Inſtitute*. This time it was ſo very remarkable, that I do not think any one remembers to have ever ſeen the like. As to its Extent, it ſpread ſo as to occupy about 140 Degrees of the Heavens: And, as to its Light, it was ſo vivid, as by it to diſtinguiſh Houſes at a great Diſtance; which ſeemed of a red Colour, and made ſome People attribute this Light to a Fire in the Neighbourhood. But when they were aſſured what it was, they remained no leſs frighted, ſuperſtitiouſly believing it impoſſible, that ſuch an uncommon Light, and of a red Colour too, like Blood, ſhould appear in the Sky without preſaging ſome unhappy Accident. While the whole City was intent upon viewing this new Appearance, I and ſome young Gentlemen were employed in calculating the *Ephemerides*; and, being appriſed thereof, we jointly began to take Obſervations of it. This uncommon Light drew to the Obſervatory ſeveral others, that were uſed to come at other times. But I ſhall only relate what is entered upon the Regiſter of Aſtronomical Obſervations, leaving to thoſe who are fond of philoſophical Hypotheſes, to inveſtigate its Cauſe according to their Fancy.

$7^{h}. 9'$. *p.m.* When we firſt perceived the *Aurora Borealis*, its Centre was near the North Pole. The Brightneſs extended along the Horizon about 70 Degrees, and its Height was judged 20 Degrees. The Sky was almoſt totally overcaſt with Clouds, but the Light was viſible in ſeveral Parts, where the Sky was clear. The Two Stars, $\zeta$ and $\varepsilon$, of the *Great Bear*, ſhone bright in the midſt of the reddiſh Light of the *Aurora*.

$7^{h}. 34'$. No Change having happened for ſome time, the Light now appeared ſomewhat weaker, and removed from its Place; for its Centre was no longer in the North, but paſſed Weſtward [N. W.]. The Stars, $\zeta$ and $\varepsilon$, were ſtill viſible, but more Eaſtward, with reſpect to that Part where the Light was brighteſt.

7h. 39′. The Light continued diminiſhing. To the Weſt, the Sky was quite overſpread with Clouds; ſo that it was not poſſible to diſtinguiſh its Limits.

7h. 42′. The *Phænomenon* on a ſudden reaſſumed new Strength, and became more vivid, and of a Colour as red as Fire.

7h. 44′. It again became languid, but was ſpreading at the ſame time. To the Eaſt, it was not poſſible to determine its Limits, by reaſon of the Weakneſs of the Light, which diſappeared by degrees. About the Pole, and to the Weſt, it was loſt behind the Clouds.

7h. 49′. It continued to ſpread wider, and had already taken in the Two Stars, β and γ, of the *Dragon's-Head*, and *Lucida Lyræ*.

7h. 52′. The Expanſion of the Light ſtill increaſed, which took in a great Part of the *Swan*, ſurrounded by a Miſt. At this time the Height of the *Aurora* was 40 Degrees, and its brighteſt Part was a little under *Lucida Lyræ*.

7h. 54′. On the other Side towards the North, the Two Stars, δ and γ, of the *Great Bear*, were immerſed in the Light.

7h. 59′. The *Aurora* formed itſelf into a concave Arch towards the Horizon. The Polar Star was near the Top of its Convexity, and ſome Stars ſhone bright in the midſt of the Light; and, among theſe, δ and γ, of *Urſa major*. The concave Part was terminated by a Baſis ſomewhat dark; which ſeparated the red Light of the Arch from a white and very bright Light, that remained within it. The Arch, which was 15 Degrees broad, was of a deeper Colour towards the Horizon than towards the Pole. The

Weſtern

Weſtern Limit, which was interrupted by Clouds, was wider and more irregular than the Eaſtern Limit. TAB. Fig. 1. exhibits the *Phænomenon* conformable to the Deſcription now given.

8h. 9′. To the Weſt, the Limit of the Arch remained confuſed, though of a red Colour, ſomewhat vivid: But to the Eaſt it became more faint, and changed rather into a whitiſh Colour.

8h. 19′. The red Light ſpread to the Conſtellation of the *Dolphin*.

8h. 22′. The Arch, which was ſtill diſtinct, grew bigger, paſſing Eaſtward by the Two Stars, ϰ and ι, of *Urſa major*, and Weſtward by the Stars of the *Swan's Tail*.

8h. 29′. *Lucida Lyræ* remained clear of the red Light, which moved higher, and was immerſed in the bright Light.

8h. 30′. At the Eaſtern Limit of the *Aurora*, that is, at 54 Degrees from the North Pole, there was ſuddenly ſeen to riſe vertically up, a Beam of Fire, at firſt of a very bright Light; but, in Proceſs of Time becoming more reſplendent, it changed into a red Colour, like that of the Moon in the Horizon.

8h. 31′. The Light ſtill increaſed in Vigour, and was now intirely like the red Rays, which are ſeparated by the Priſm. Its Figure was changed; for it reſembled a Pyramid, with its Baſis on the Horizon, 4 Degrees wide, and its Height was about 20 Degrees. Near the Top of the Pyramid, the Redneſs was leſs than at the Baſis, and its Limits were not very diſtinct.

8h. 34′. The red Light continued ſpreading, and made, as it were, a Baſis of a weaker Redneſs, for the aforeſaid Pyramid. At this time the *Aurora* appeared unſettled and curious, as in Fig. 2. TAB. V. At its Eaſtern Limit, the Pyramid continued viſible, but of a more intenſe Colour towards the North, and from its Middle there ſhot up vertically a Streak of Light, between a white and a yellow Colour. A very dark narrow Cloud croſſed the whole *Phænomenon*, and went to terminate in the Pyramid. At the upper Part, a conſiderable Tract of the Heavens was enlightened with a very vivid red Light, which was interrupted by ſeveral Streaks or Columns of a bright yellowiſh Light. The ſaid Streamings ſhot up vertically, and parallel to each other; and the narrow Cloud ſeemed to ſerve them for a Baſis. Under the Cloud there iſſued forth Two Tails of a whitiſh Light, hanging downward on a Baſis of a weak Red, and it ſeemed as if they kindled and darted the Light downward. There was likewiſe ſeen a white Streak, which paſſed acroſs theſe Two Tails, and extended from one End of the *Phænomenon* to the other, in a Poſition almoſt parallel to the above-mentioned Cloud. Weſtward, the Sky was all cloudy, ſo as to ſuffer nothing to be obſerved. At this time ſome of the Company perceived other little Shootings, like thoſe which are frequently ſeen in Summer, and are commonly called *falling Stars*. More than one of theſe were obſerved in that Part of the Heavens that was free from the *Phænomenon*, at about 45 Degrees of Altitude, not far from the Eaſt.

8h. 36′. There reappeared a Portion of the Arch, which was ſeen at firſt. The Pyramid was ſpreading, and loſing its Figure.

$8^{h}$. $38'$. The very bright red Light, which firſt formed the Pyramid, ſpread Northward on the Tracks of the Arch; which nevertheleſs contained within it a bright Light extending to the Horizon, excepting that it was covered here-and-there by Clouds.

$8^{h}$. $39'$. The Stars, ζ, ε, of *Urſa major*, ſhone through the red Light, which contained ſeveral white luminous Streaks.

$8^{h}$. $44'$. The red Light, now very vivid, was all interſperſed with white luminous Streams, which darted out of the Baſis or lower Extremity of the Arch. To the Weſt, the Northern Light terminated exactly in a white Streak, and Eaſtward it ſpread as far as the Horizon. The North Pole began again to become red, yet there ſtill remained ſomewhat of the uſual bright Light between the Red of the Pole, and that of the Arch.

$8^{h}$. $51'$. The red Arch began alſo to appear to the Weſt, and reached to the Stars of the *Swan*, which at firſt were hid by the Clouds.

$8^{h}$. $54'$. The red Light began to ſpread on every Side, but ſtill contained within it ſomewhat of the Brightneſs. The *Zenith* was now all red, and with it that Part of the Sky which takes in 70 Degrees on each Side. Fig. 3. Tab. V. exhibits the *Phænomenon* as it was obſerved at that Time. The Circle deſcribed by the Figure denotes a Parallel to the Horizon at the Altitude of 45 Degrees; on which is a Portion of the Arch, ſo often made mention of.

$8^{h}$. $56'$. There appeared ſeveral white Streaks to the Eaſt, where the Light of the *Aurora* was ſtrongeſt; which Light was riſing higher, and ſeemed to have intirely quitted that Part of the Sky near the Horizon.

9h. 4′. There now remained but a little reddiſh Light at the North Pole; all the reſt was collected near the *Zenith*, not extending lower than the Star α of *Urſa major*. In the South, where the Sky was clear, there were ſeen ſome of thoſe Stars which we have called *falling Stars*.

9h. 6′. About the *Zenith* the Light continued red and vivid, but deſcended lower. The *Aurora* abandoned the Eaſt, and took Poſſeſſion of the North-weſt. It appeared as if the Coruſcations had almoſt conſtantly taken their Riſe from the Eaſtern Quarter, and afterwards extended to the Weſt.

9h. 9′. A conſiderable Streak, or Tract of red Light, more vivid than the reſt, croſſed the Stars of the *Swan*, almoſt horizontally.

9h. 12′. In the Eaſt, where the *Aurora* ſeemed to have intirely diſappeared, it began again to make its Appearance; but to this Time the Light was but faint, in compariſon of that which was ſeen in the Beginning.

9h. 19′. The Light was become pretty faint, and confined within a ſmall Space, at the Height of about 40 Degrees, above the North-weſt. Many little Changes, that occurred, are not ſet down, it being impoſſible to keep an Account of them all, inaſmuch as they ſucceeded one another very quick.

9h. 34′. The *Aurora* ſeemed intirely extinguiſhed. In ſome Minutes after, it began to revive; but the Clouds, which were in great Numbers, and ſpread round on every Side, left but a few little Spaces free. The greateſt Brightneſs was in the *Zenith*, which appeared like a red Veil, declining to the North, where it loſt itſelf behind the Clouds.

$11^{h}$. $6'$. The Light gathered new Strength, and was all at North, up to 20 Degrees of Altitude, the *Zenith* being quite clear of it. The Brightneſs was greateſt about the Pole, and grew weaker as it receded from it, taking in, upon the Whole, 90 Degrees of the Horizon. The Clouds continued to increaſe, and prevented ſeeing the *Phænomenon* but now-and-then; and in this manner the Light laſted to the 13th [1ſt] Hour. Some ſay they have ſeen Foot-ſteps of it at the 16th [4th] Hour; but our Company parted long before from the Obſervatory, thinking it intirely at an End; and the rather, becauſe the Clouds had deprived us of all Hopes of being able to purſue the Obſervation.

I ſhall add ſome things which have been courteouſly communicated to me by the celebrated Dr. *Beccari*, and are of his own Obſervation.

The Day of the *Aurora*, the Barometer was very high, *viz.* at 28 Degrees 5 $\frac{1}{2}$ Lines. The preceding Day, the Winds were different, in different Regions of the Air. Near us [the Earth], the Wind was Weſt-north-weſt, and pretty cold. Higher up, the Clouds came from the Eaſt, and moved Weſtward; which Clouds were globular Collections of Miſts. Above that Region the Wind blew at South-weſt by South, as appeared by ſome ſmall Fleaks of Clouds coming from that Quarter. The 16th Day, the Wind that reigned in the Region of the Clouds was *Greco-tramontana*, and was in the Second Degree of Strength.

Several Perſons have poſitively aſſured us, that, in the Evening of the 16th Day, they perceived a certain Stench in the Air, like that which is ſometimes occaſioned by a Fog. The ſame has been taken notice of at other times, when ſuch *Phænomena* have appeared.

There was a very thin Fog in the Air not only on the 16th Day, but alſo on the preceding and enſuing Days. The Mornings of the 17th and 18th, before and a little after Sun-riſe, the Air appeared of an uncommon firy Colour. The Evening of the 17th, the Crepuſculum was of an extraordinary Height. Between the North and Weſt, there was ſeen a very thin red Vapour, which laſted almoſt till Night.

The various Appearances of the *Aurora*, obſerved by that Gentleman, are here omitted, becauſe they very well agree with thoſe above deſcribed.

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## 4. *Splendidiſſimum lumen Boreale* Romæ *viſum die* 16. Decembri 1737. *Obſervante* Didaco de Revillas, *Abbate* Hieronym. *pub. Math. Prof. & Reg. Societ.* Londinenſis, *necnon Acad. Scient.* Inſt. Bonon. *Socio.*

ETSI hora dumtaxat p. m. VII. cum ſemiſſe de ſplendidiſſimo cœlum illuſtrante lumine monitus ejus obſervationi vacare cœperim; abs oculatis tamen, & fide dignis teſtibus hæc accepimus: nimirum, 1°. Crepuſculo vix finito humiliorem cœli borealem plagam rubro colore infectam, ignitamque conſpici cœpiſſe; nonnullis poſtmodum albicantibus ſtriis inde aſ-

aſſurgentibus. 2°. A boreali verſus occiduam plagam paullo poſt incenſionem declinâſſe; ſtriis modo evaneſcentibus, modo iterum conſpicuis, quæ duobus albicantibus arcubus concentricis, & horizonti proximis, ad aliquod tempus inſiſtebant. 3°. Prope horum fimbrias vividius lumen ex horizonte ejaculari. 4°. Demum boream verſus hora circiter VII. conflagrationem denuo migrâſſe; arcubus jam tunc evaneſcentibus. Hæc ab aliis: en a nobis obſervata.

H. VII. 30′. Igneum rubrumque lumen, cœlo ſereno ac quieto, borealem plagam illuſtrabat, quod ad altitudinem graduum circiter 8 protendebatur, amplitudine in ortum gr. 10, in occaſum gr. 35. fixis trans lumen emicantibus. Prope horizontem inſueto candore veram auroram æmulante cœlum ſplendeſcebat.

40′. Nigricans ſtria verſus Polarem ſtellam aſſurgebat; atque interea temporis ſanguineus color ſenſim propagabatur.

H. VII. 45′. Inter gr. 26 & 30 a borea occaſum verſus major conflagratio colligebatur; ibique duæ leviter albicantes ſtriæ nonnihil inferius convergentes in ſublime levabantur. Paullo poſt ad altitudinem gr. 40 conflagratio conſcendebat: boreali plaga vix ad ſenſum rubeſcente.

H. VIII. Ubi paullo ante vividior inflammatio, minuebatur. Ad boream tamen, & ad ONO. ulterius ad altiora cœli progrediens, iterum accendebatur.

15′. Horizontalis candida lux ſub elevationis angulo gr. ferme 7. apparebat in tota boreali plaga. At quæ ſuperiores occupabat partes, nonnihil ad horizontem prope NO. conflagratio pertingebat. Forte arcus figuram candor hicce nanciſcebatur; ſed interjecta ædificia ejus conſpectum prohibebant. Paullo poſt ad gr. occid. 32. a borea ruber color ferme evaneſcebat. Ad boream, & ad NO. intendebatur. Interea temporis circa Lucidam Lyræ area propemodum elliptica, vivido colore rubra, majori axe ad horizontem normali apparebat; ex qua candicantes ſtriæ verſus cœli ſummitatem emittebantur. Alia vero pariter candicans ab ellipſis imo ad Urſæ majoris caput extendebatur. Areæ major axis gr. circiter 10 occupabat.

20′. Nova hæc elliptica conflagratio ſenſim elevabatur; & nonnihil ad occaſum declinans a Lucida Lyræ recedebat, trilateram, ſeu potius circuli ſectoris figuram, converſo ad horizontem arcu, aſſumendo. Sectoris hujuſce centrum obtinebat ſtella in Cygni pectore emicans. Sub idem fere tempus a boreali conflagrante plaga reſplendens ſtria verſus ſectoris centrum inclinata figuram trapetiam intermediam ferme obtenebratam terminabat.

45′. Lucidus circuli ſector evaneſcebat. Nubes nigricans intra gr. 28 & 34 a borea in occaſum. Conflagratio pene tota extinguebatur præterquam circa Polarem ſtellam.

50′. Iterum inter Polarem, & Urſæ majoris caput colore ſanguineo perfuſum lumen vel maxime accendebatur ultra graduum 60 altitudinem protenſum. Atque interim occaſum verſus alia cœli portio conflagrabat a priore ſejuncta. Paullo poſt interjectum quoque ſpatium ſuperius inflammabatur, relicto prope horizontem ad NNO. albicante lucidoque intervallo.

H. IX. Conflagratio major circa Urſæ majoris caput. Rubra lux ferme uſque ad *Zenith*; iterumque verſus occiduam plagam diffundebatur. Plures nigricantes ſtriæ nonnihil inferius convergentes intra conflagrationem attollebantur, quarum amplior Polarem attingebat.

H. IX. 10'. Striæ evaneſcebant, vegetiore conflagratione ſupra Urſæ majoris caput perſeverante; & ad horizontem uſque paullo ante aliquantum ſeſe extendente.

15'. Major conflagratio circa Polarem. Totum tamen boreale hemiſphærium plurimum rubebat.

20'. Ad gr. 32 a borea in occaſum, ampla candicans ſtria aſſurgebat; & circa Urſam majorem minuebatur accenſio. Intra gr. 10 & [illegible] perſeverabat; ubi adhuc rubro colore horizon, occaſum verſus albeſcens, inficiebatur.

30'. Plurimum langueſcebat accenſio: iterumque juxta boream intendebatur.

40'. Evaneſcebat iterum, tenui occaſum verſus perſeverante fulgore, qui tardius, ſed pedetentim extinguebatur.

H. X. Iterum ad boream inflammatio, quæ nonnihil orientem verſus pretendebatur; inter utramque tamen accenſionem ſpatio gr. circiter 15 interjacente; in quo, utrinque evaneſcens conflagratio, ſatis tamen diminuta, mox colligebatur.

15'. Occaſum verſus cœlum nubilum. Solus horizon ſudus. Conflagratio jam extincta, vix tenui ad boream rubicundo colore ſuperſtite.

H. XI. Iterum ad NNE. reviviſcens ad medium uſque noctis perſeverabat. Senſim deinde minuebatur. At quæ ſupererat dubia lux aeriſque rubor, vix poſt duas horas evaneſcebat.

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|---|---|---|---|
| Die 16h. 9'. a. m. | | Barom. | 28. 1. |
| h. 9. p. m. | | | 28. 1 $\frac{1}{10}$. |
| D. 17h. 7. a. m. | | | 28. 1. |

5. *Ex-*

## 5. *Extract of a Letter from Mr.* James Short *to Mr.* George Graham, F. R. S. *dated at* Edinburgh, Dec. 6. 1737. *concerning the ſame* Lights.

——YEſternight we were ſurpriſed upon looking out at the Windows, about Six o'Clock, to find the Sky, as it were, all in a Flame; but upon further Inquiry, it was nothing but the *Aurora Borealis*, compoſed of red Light. There was an Arch of this red Light reached from the Weſt, over the *Zenith*, to the Eaſt; the Northern Border of this Light was tinged with ſomewhat of a blue Colour. This *Aurora*, as far as I ſaw, did not firſt form in the North, and after forming an Arch there, riſe towards the *Zenith*, as they commonly uſe to do; neither did the Light ſhiver, and by ſudden Jirks ſpread itſelf over the Hemiſphere, as is common, but gradually and gently ſtole along the Face of the Sky, till it had covered the whole Hemiſphere; which alarmed the Vulgar, and was indeed a ſtrange Sight: In ſome Places we ſaw the Clouds paſs betwixt us and it. During the whole Time, which was from Five o'Clock till Eight, there was a moſt violent Wind from the South-weſt. I looked at *Jupiter* with 15 $\frac{1}{2}$ Inch Teleſcope, but the Air was in ſuch an Agitation I could not ſee him diſtinctly. *Lucida Lyræ* appeared through the red Light very dim to the naked Eye. About Eight o'Clock this red Light formed a *Corona*, a little to the South of the *Zenith*; and inſtead of a dark Fund in the Middle, as uſual in ſuch Occaſions, it was of a deep Red. There was always a great Circle of this Light came from the Weſt to the *Zenith*, which ſeemed to be the Magazine whence all the reſt were ſupplied. It is but about a Year ſince I firſt obſerved this red Light in the *Aurora Borealis*, and only then in very ſmall Quantities. I ſhall be glad to know if there is any ſuch Alteration in the Light at *London*.

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### 6. *An Abſtract of a Letter from* John Fuller, *Eſq; jun.* F. R. S. *to the* Preſident, *concerning the* Red Lights *ſeen* Dec. 5. 1737.

*** IT was a ſtrong and very ſteady Light, as near as can be of the Colour of red *Okre*; it did not ſeem to dart or flaſh at all, but continued going on in a ſteady Courſe againſt the Wind, which blew freſh from the South-weſt. It began about North North-weſt, in Form of a Pillar of Light, at about 6h. 15′. in the Evening; in about 10 Minutes, a Fourth Part of it divided from the reſt, and never joined again; in 10 Minutes more it deſcribed an Arch, but did not join at Top; exactly at Seven, it formed a Bow, and ſoon after quite diſappeared; it was all the while lighteſt and reddeſt at the Horizon: It gave as much Light as a Full Moon.

At 8h. it began again exactly North: It was very light then, but not near ſo light as before; in half an Hour it made an Arch from Eaſt to Weſt, and went quite away to the South, when it ended much with the ſame Appearance as it began in the North, but not quite ſo red.

*Roſehill*, [*Suſſex*] *Dec.* 20. 1737.

VIII. *A*

## VIII. *A ſhort Account of Dr.* Jurin's *Ninth and laſt Diſſertation* De Vi Motrice, *by Mr.* John Eames, F. R. S.

THE laſt Diſſertation is * new, and treats of the Motive Forces of Bodies, whether they are to be eſtimated by the Velocities, or the Squares of the Velocities, when the Maſſes are equal. The Original of this Diſpute among the Mathematicians, the Author aſcribes to a Slip committed by the celebrated Mr. *Leibnitz*, in the Year 1686. and the Continuance, to the Neglect of the Times, wherein equal Effects are produced. The one Side aſſerts all Cauſes to be equal, whoſe Effects are ſo, whether the Times, during which the Cauſes act, are ſhorter or longer. The other, on the contrary, maintains, that equal Effects may ariſe from unequal Cauſes, if the Times of Action are unequal; that conſequently the Times, as well as the Effects, ought to be taken into the Account.

He wiſhes the Gentlemen on the other Side of the Queſtion would produce ſome Experiment in their Favour, where the Equality of the Times is preſerved; ſince all the Experiments they have hitherto made, and argued from, may juſtly be ſet aſide, as incompetent, on the Account of the Inequality of the Times of Action.

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* The Eight preceding Diſſertations had been before printed ſeparately; but were now all collected together, with the Addition of this Ninth, and publiſhed in one Volume in *Octavo*, *London*, 1732.

The Author then proceeds to prove the Truth of the common Opinion of the Forces in equal Bodies being proportional to their Velocities. This he does by Three Mediums, the Firſt taken from the Action of a ſingle Spring upon the ſame Body: The Second from ſome Experiments of Mr. *Mariotte*: the Third from the joint Action of ſeveral Springs upon Two unequal Bodies.

I. A ſingle Spring, fixed to a moveable horizontal Table, is made to communicate to the ſame Body, Degrees of Force unqueſtionably equal, while the Degrees of Velocity communicated at the ſame time are alſo undoubtedly equal; therefore the Forces are proportional to the Velocities.

II. In Mr. *Mariotte*'s Experiments, the Impreſſions made upon equal Surfaces in the ſame Point of Time, are found to be in the Duplicate *Ratio* of the Velocities; but the Maſſes or Numbers of impinging Particles are in the ſimple *Ratio* of the Velocities: conſequently, the Maſſes and Velocities conjunctly being in the Duplicate *Ratio*, *i.e.* as the Impreſſions, muſt alſo be as the Forces which made them: Which is the old Opinion.

III. A complicated or bent Spring interpoſed between Two unequal Bodies, acting upon each with an equal Preſſure, and during an equal Time, muſt communicate equal moving Forces to each; but their Velocities are by Experiment reciprocally proportional to their Maſſes; therefore their Maſſes, drawn into their reſpective Velocities, are alſo equal, as were their moving Forces; and by conſequence their moving Forces are as the Maſſes and Velocities conjunctly: Which is the generally received Opinion.

In the Appendix, the Author anſwers ſome of the principal Arguments brought in favour of the contrary Side.

I. The firſt is drawn from the compound Motion of a Body along the Diagonal of a Rectangle, whoſe Sides repreſent the ſimple Motions. Here it is ſaid, that the ſimple Forces are no-ways contrary to each other; that being united or added together in the compound Force, that compound Force will not be to both or either of the ſimple Forces, as the Diagonal is to both or either of the Sides; but as the Square of the Diagonal to the Sum of the Squares of the Sides, or to the Square of either Side reſpectively. He anſwers, The ſimple Forces, while they act in their proper Directions, are not contrary to each other, either Wholly or in Part; but when conſidered as contributing to the Motion of the Body in the Direction of the Diagonal, Part of the one acts contrary to Part of the other, and deſtroys it; as is evident, if you reſolve each ſimple Force into two others, one acting along the Diagonal, the other in a Direction perpendicular to it. And then it is to be obſerved, that the Sum of the two former is equal to the Diagonal (while the two latter deſtroy each other): Which is perfectly agreeable to the old Opinion, but not at all to the new; for the demonſtrating of which this Argument is brought.

II. The ſecond Proof is taken from the equal Compreſſion of Four equal Springs, before the Force was conſumed, by the ſame Body moving with double the Velocity; and labours at the Bottom under the ſame Parallogiſm.

III. The laſt Argument is founded upon the learned and ingenious Mr. *Poleni's* Experiment, wherein equal Cavities are formed in ſoft Subſtances, by equal Bodies falling from Heights reciprocally proportional to their Maſſes. This the Author ſets aſide, as inſufficient, ſince the Times of forming theſe equal Cavities are unequal, and unequal Cauſes may produce equal Effects in unequal Times. The learned Mr. *Poleni* does, indeed, reply, and ſay, that the Formation of theſe Cavities ſeems to be inſtantaneous: But the ingenious Author ſhews the contrary, and that from a Poſition allowed of by *Poleni* himſelf, in his Reply.

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## IX. *An Account of ſome remarkable Stones, taken out of the Kidneys of Mrs.* Felles, *upon opening her Body after her Deceaſe, by* Noah Sherwood, *Surgeon.*

UPON opening the Body of Mrs. *Felles*, I found nothing amiſs in any of the *Viſcera*, till I came to the Kidneys, both of which were conſiderably inlarged, and of an oblong Figure, and had ſeveral Protuberances bunching out, which made the Surface appear almoſt like a Beeve's Kidney. Upon feeling them externally, I could plainly perceive they were cauſed by Stones: I took them out of the Body, and laid them open Longitudinally, and found in the Right Kidney ſeveral Stones of an irregular Figure, branched like Coral: They had extended themſelves beyond the Capacity of the *Pelvis* on every Side, (al-

(although that was greatly inlarged, ſo as each of them to contain half a Pint of *Pus*, or more) forming for themſelves Cells in the *Parenchyma* of the Kidneys, which Cells were all ulcerated within, and full of Matter, communicating with the *Pelvis*; the whole Subſtance of the Kidneys was ſcirrhous. The Patient had long been troubled with grievous Pains of the Back, and had voided great Quantities of *Pus* with all the Urine ſhe made, ſo that there was no doubt of there being Ulcers in her Kidneys; and ſhe herſelf often declared there were Stones in the Kidneys, which, upon any Motion, ſhe could feel grate againſt each other. The Bladder and Ureters ſeemed to be leſs hurt by ſo long a Diſcharge of Matter than might reaſonably be expected, being only a little excoriated; and indeed leſs than I have found in other ſeemingly parallel Caſes, where the Matter has been of a more corroſive Nature; but in this Caſe it was thick and ſmooth.

The Left Kidney was likewiſe full of Matter, and contained only One Stone, larger than any of thoſe in the Right, nearly of a triangular Figure, with the Angles growing pointed at their Extremities.

# X. *A Deſcription of a large* Lake *called* Malholm Tarn, *near* Skipton *in* Craven, *in the County of* Yorkſhire; *by* John Fuller, *Eſq; jun.* F. R. S.

*MAlholm* is a pretty Country Village, ſituated on the Southern Side of a monſtrous high Hill, the Aſcent of which is not very ſteep. By a Break between this Hill and another, which are joined by a Rock, which meaſures 82 Yards perpendicular, and ſeems to be about Two-thirds of the Height of the Hill, I conclude the Hill to be about 120 Yards perpendicular. On the Top of this Rock there ſtill remains the Appearance of a Chanel for 2 or 300 Yards together, which, by its having no Mould or Earth to cover it, I judge to have been a Paſſage for that Water, which formerly uſed to tumble over the Precipice, but now has found a Paſſage under-ground, and flows out at the Bottom of the Rock, being now called *Air-Head*, *viz.* the Head of the River *Air*. The Rock is called *Malholm Cove*.

Between the Top of this Mountain and the Tops of Four others, is *Malholm Tarn** (I ſay the Tops of them, for though they ſteep a Quarter of a Mile towards the Lake from their Tops, it is at a Mile and an half down to the flat Country on the Outſide). This Lake is between 3 or 400 Acres. The Shape of it is a Parallelogram, the Length of which equals about twice the Breadth: There are no Weeds in it. In a fine ſtill Day, you may ſee the white chalky Bottom, where it is 10 or 12 Foot deep. I wonder

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* A *Saxon* word for a Lake.

*Camden* takes no Notice of this Lake; for it muſt have been there in his Time, and he muſt have been very near it; for he deſcribes a Precipice, which I am pretty certain is the Northern Side of one of thoſe very Hills which help to form *Malholm Tarn*. There are but Two viſible Springs that ſupply it with Water, one lies Eaſt, the other North-weſt; and by what I could gueſs, there are only theſe Two Springs; for the Diſcharge ſeems to be no greater than what theſe Springs ſupply.

The ſuperfluous Water of this Lake is diſcharged by a gliding Stream, about Four Feet broad, and Two or Three Inches deep; which runs above-ground about 2 or 300 Yards, and then dips under-ground at Two different Places about 10 Yards diſtant from one another. What becomes of theſe Streams after their dipping, (though the Relation appears ſomewhat fabulous, yet) as it is affirmed by all the Men of Credit in the Neighbourhood, I could not help believing it. About a Mile below *Malholm* Village there are Two Springs that diſcharge themſelves into the River *Air* about 10 Yards diſtant from one another, one ſomewhat greater than the other. The Neighbours aſſured me that if Wheat-chaff was put into either of the Rivulets at the Place of their dipping, in about Eight Hours time it would come out at the greater or leſſer Spring, and not out of both, into the River *Air*, which is from the Place of their firſt dipping about Two Miles and an half. By this it appears, that theſe Two Rivulets never communicate in their ſubterraneous Paſſage.

The *Tarn* abounds with only Two ſorts of Fiſh, *Trouts* and *Perch*: The *Trouts* very large and red; the

*Perch*

*Perch* far exceed in Size and Goodneſs any I have ever ſeen, being commonly 20 Inches long, weighing Four or Five Pounds. They are taken only with Hooks, it being ſo deep and ſtony, that you cannot draw a Net: The only Bait for them is an Earth-worm; the rocky Soil, and the Springs coming ſo little a Way, affording them very little of that ſort of Food.

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## XI. *Extract of a Letter from Monſieur* de Bremond, *M. D. to Dr.* Mortimer, *concerning a* File *rendered Magnetical by Lightning. Tranſlated from the* French *by* T. S. *M. D.* F. R. S.

IN N° 437. of the *Philoſophical Tranſactions* you have publiſhed, Sir, a Letter of Dr. *Cookſon*, of *Wakefield*, on an extraordinary Effect of Lightning, which communicated Magnetiſm to ſeveral Iron Tools I have received a Letter from the Coaſt of *St. André* in *Dauphiné*, dated *Sept*. 7. 1739. giving an Account of a Fact of the ſame Nature, which I here ſend you as I received it.

" Three Weeks ago the Lightning fell 30 Paces
" from my Houſe on that of a Clock-maker. I ſhall
" not enter into the Particulars of the Ravage it
" committed. Every-body knows how ſurpriſing
" the Effects of Thunder are: But here is one that is
" very ſingular. The Thunder broke one of the
" Clock-maker's Files, four Inches from the End;
" ſo that there ſtill remained Seven Inches of it in the
" Handle;

“ Handle; and the Piece of Four Inches long, that was broke off, remained on the Shop-board.

“ The next Day after the Accident, the Clock-maker, obſerving that the remaining Part of this File might ſtill be of Service to him, took it up, and worked with it. But he was much ſurpriſed to ſee, that Iron followed the End of his broken File. He applied this End to a Punch (or Drill), and the Punch was immediately attracted to the File. He called to me, and I made ſeveral Trials of this attractive Quality. I took the Piece of the File that had been broken off, and applied it to an iron Ring for hanging Keys; which it lifted up perfectly well, and held ſuſpended as long as I thought proper. I doubted not but it was the Lightning that had communicated a magnetic Quality to this File; and I found, upon Trial, that this Quality was given only to the Inſide of the File, and the broken Piece; for I applied Bits of Iron to every Side of it, without any Effect, the Virtue reſiding no-where but in the Place that was broken. I broke in two the ſame Piece of Four Inches; and one of the Two Pieces attracted Iron at both Ends, the other only at its broken End. I rubbed the Point of my Knife on one of theſe two Bits of the File, and it communicated to my Knife a Degree of Magnetiſm ſufficient to raiſe Needles, and hold them ſuſpended.”

I wiſh, Sir, this Obſervation may prove agreeable to you: It will ſerve at leaſt to multiply the odd Effects of Lightning, and the Wonders of Magnetiſm.

I have the Honour to be with all poſſible Eſteem and Reſpect,

*SIR*,

*Your moſt humble and*
*moſt obedient Servant,*

Paris, June 4. N. S.
1740.

**De Bremond,**
*of the* Royal Academy
of Sciences.

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## XII. *An Account of* Tumours, *which rendered the Bones ſoft. Communicated to the* Royal Society *by Mr.* Pott, *Surgeon.*

IN *November* 1737. a Gentleman, aged 27, complained to me of a Swelling in the Inſide of his Right Thigh (being in every other reſpect in perfect Health). Upon Examination it appeared to be an encyſted Tumour of the Steatomatous kind, lying looſe between the *Sartorius* and *Vaſtus internus* Muſcles. I told him, I could propoſe no way of curing it, but by taking it out; which was accordingly done, and he very well in Six Weeks.

After this he continued well for near a Year (except that he now-and-then complained of a ſlight Pain in the Joint of that Hip, which went off and returned at different times); and then fell into ſuch a Diſpoſition to ſleep, that no Company or Diverſion, nor his own Endeavours to the contrary, could keep him awake after Eight or Nine o'Clock in the Evening, if he ſat down.

This continued on him for Three or Four Months, and then the Pain in his Hip grew worſe; for which he uſed the Cold-bath, Fleſh-bruſh, and riding on Horſeback, but without any Effect.

Hereupon he asked the Advice of Dr. *Beaufort*, who put him into a Courſe of the *Æthiops Mineral*, *Cinnabar* of *Antimony*, and *Gum Guaiacum*, with the *Spa-water*, and purging with *Calomel*, by Intervals: This Method he purſued for a conſiderable time, but without any Benefit.

After this, by the Advice of ſome Acquaintance, he took half a Drachm of *Salt* of *Hartſhorn* Night and Morning, in a Draught of warm *Whey*, for ſome time; but without any ſenſible Effect, even by Perſpiration.

Some little time after this, he began to complain of a ſlight periodical Heat and Thirſt, which returned every Night, with a quick hard Pulſe, but which was not ſo great as to make him uneaſy.

It was now *September* 1739. when, having an Opportunity of going with ſome Friends, he determined to try what the *Bath* would do for him: In his Journey thither, the nocturnal Heat and Thirſt increaſed ſo much, as to prevent his ſleeping; but in the few Days that he ſpent in recovering from the Fatigue of the Journey, they ſeemed to go off again.

He then began to uſe the Waters both internally and externally; upon which the laſt-mentioned Symptoms again appeared, and he was obliged to deſiſt, and uſe cooling Medicines.

His Phyſicians then adviſed him to bathe the affected Limb only; upon which they returned again, and with ſuch Violence, that the farther Uſe of the Waters was thought highly improper, and he left them off.

During this time the Sight of his Left Eye grew dim, which Dimneſs increaſed gradually for ſome little time, till he became quite blind of that Eye; the Bulb of it being conſiderably inlarged, and thruſt forward out of the Orbit.

For the moſt part of the Time he had been at *Bath*, he had generally been very coſtive; and, upon leaving off the Water, had no Stool for ſome Days; for which Reaſon a common Clyſter was given, and produced ſo profuſe a Diſcharge of ſerous Matter, and continued for ſo many Hours, (almoſt inceſſantly) that he was reduced as low as poſſible.

For ſome time paſt, ſeveral ſmall Tumours had appeared in different Parts of him, *viz.* Five or Six on his Head, Two or Three in his Back, and one in the Neck, all lying juſt under the Skin, and ſenſibly increaſing every Day, till they came to a conſiderable Size.

*December* the 2$^{d}$ 1739. he returned to *London.*

His chief Complaints now were an exceſſive Languor, an Inability to move his Right Hip (and when moved by another Perſon, a very acute Pain in it); an Incapacity of ſleeping when in Bed, and an intenſe Thirſt in the Night, with a quick hard Pulſe.

He now took the Advice of Dr. *Hartley* and Dr. *Shaw*, who preſcribed him the *Cinnabar* of *Antimony* Three times a Day, to drink the *Selters* Water, and keep to a cooling Regimen; and allowed him a moderate Doſe of the Pill *Matthæi* every Night; by means of which he got ſome Sleep, of which he had for ſome time been abſolutely deprived.

When he had taken the *Cinnabar* Five or Six Days, and during that time had no Stool, it was thought proper to give him a Clyſter; which brought away all the Medicine, without the leaſt Alteration; nor was there ever after this Time any Appearance of any *Mucus* being ſecreted by the Inteſtinal Glands, he never going to Stool above once in a Week (and then there came away a few Lumps of Excrement as hard as Pieces of Wood); which were expelled with ſuch Labour and Fatigue as can hardly be imagined; though he generally took an oily Clyſter to render it more eaſy, and waſhed down his Medicines with a ſoapy Draught.

The Joint of the Hip was now become quite ſtiff, all the Inguinal Glands being loaded with the ſame kind of Matter of which the other Tumours ſeemed to be compoſed; and a large Cluſter more of them might be felt under the *Glutei Muſcles*, and behind the *Trochanter*.

The *Cinnabar* was now left off, and mercurial Unction propoſed and conſented to; and accordingly a proper Quantity was rubbed in every Night, ſtopping now-and-then to ſee what Turn it would take; and in this Courſe he continued for more than a Month, but without any Benefit, nor did the *Mercury* produce any viſible Effect on him.

Sir *Edward Hulſe*, being called in, directed the burnt Sponge, which he took for ſome time, till, growing worſe and weaker, he determined to try Mr. *Ward*.

He took his ſweating and purging Medicines Two or Three times, but found no ſort of Effect from them; and being now quite tired of Phyſic, and reduced extremely low, he determined to paſs the reſt of his Time as eaſily as he could, by gradually increaſing his Opiate; and in this manner languiſhed, incapable of ſtirring or helping himſelf, till the 2d of *May* 1740. and then died.

For a conſiderable Time before he died, he was nouriſhed by Fluids only: Yet, as ſoon as ever they were received into the Stomach, in however ſmall Quantity, they gave him an acute Pain at the Bottom of his Belly, juſt above the *Pubis*.

For Two Months, or more, before his Death, he could never make any Water while he was up, but always made a good deal at different times when in Bed.

Soon after his Return to *London*, I opened the Tumour I had taken out of his Thigh Two Years before, and found the Inſide of it oſſified.

. . . . . . . . . . . . . . . . . . . .

Upon Diſſection, the firſt thing that offered itſelf was a large *Tumour* on the *Sternum*, which had been perceived about Three Months before he died: It was as large as a *Turkey's Egg*, and ſo hard and immoveable, that I was in doubt whether it was upon or under the Bone.

Upon removing the Skin, it appeared covered by the Expanſion of the Tendons of the intercoſtal Muſcles, and the *Perioſteum*: This Coat being taken off, it was of a ſuetty kind of Subſtance for about half an Inch deep; and below this was a kind of Cartilage intermixed with a great many bony Particles.

I then ſhaved off all this diſeaſed Body even with the Surface of the reſt of the *Sternum*, but found no Bone, it being quite diſſolved and confounded with the Maſs of Matter that compoſed the *Tumour*, which was equally protuberant within the *Thorax*, and compoſed of the ſame Materials.

Part of the Fifth and Seventh Ribs were diſſolved in the ſame Manner, into a kind of Subſtance between Bone and Cartilage, with a thick Coat of ſteatomatous Matter.

Within the Cavity of the *Thorax* were Thirty-ſeven of theſe diſeaſed Bodies, moſt of them attached either to the *Vertebræ* or the Ribs; and where-ever they were attached, the *Cortex* of the Bone was deſtroyed, and its internal cellular Part filled with the diſeaſed Matter.

Immediately above the *Diaphragm* was a large ſcirrhous Body, lying acroſs the Spine and the *Aorta*, the latter of which lay in a *Sinus* formed in its lower Part; it had no Attachment to any other Part, and weighed 13 Ounces and a half; and from its Situation, I think, muſt have taken its Riſe from ſome of the *Lymphatic Glands* lying about the *Thoracic Duct*.

From the Origin of the *Aorta*, from the Heart, quite up to the Baſis of the *Cranium*, all the Blood-veſſels were ſurrounded with theſe ſcirrhous Bodies, and the *Thyroid Gland* was diſeaſed in like Manner, and bony within.

On the Left Side was another of theſe Bodies, made out of the *Glandula Renalis*, weighing Nine Ounces Three-quarters.

On the Right, the *Glandula Renalis* was in a natural State; but the *Cellular Membrane*, which ſurrounds the Kidney, was filled with a large Cluſter of theſe Bodies of different Sizes, ſome of them intirely ſuetty, others intermixed with bony Particles: Three or Four of them were attached to the Body of the Kidney, and theſe were a ſort of *Cartilage*, beginning to oſſify.

The *Pancreas* was quite ſcirrhous, and very large.

One very large *Tumour* ſprung from the ſpongy Body of the Third *Vertebra* of the Loins, the bony Texture of which was ſo diſſolved, and mixed with the Matter of the *Tumour*, that the Knife paſſed through it with great Eaſe.

The inner Side of the *Os Ilium*, all the *Iſchium* and *Pubis*, were covered with theſe Appearances; and, upon removing them, the Bone was found in the ſame State as the *Sternum* and Ribs.

The Middle of the Right *Os Femoris* was ſurrounded with a Maſs of the ſame Matter, and the Bone underneath in the ſame State.

In the Bottom of the Orbit, ſurrounded by the *Recti Muſcles*, was a pretty large *Steatoma* which occaſioned the Protruſion of the Eye; and, by preſſing on the Optic Nerve, (in all Probability) the Blindneſs.

# XIII. *A Caſe wherein Part of the* Lungs *were coughed up. Preſented to the* ROYAL SOCIETY *by* William Watſon, F. R. S.

*THomas Halſey*, aged about 70, of a ſhort Make, and pretty fat, being in a tolerably good State of Health, (unleſs, as for ſome Years paſt, troubled with frequent coughing upon Motion) was ſeized *Sept.* 23. 1740. with a violent Fit of Coughing, in which he fell down, as the By-ſtanders thought, dead, and diſcharged near a Quart of Blood at his Mouth, in a very large Stream, mixed with many Portions of a ſeemingly grumous Matter. His coughing Fit continued near Three Minutes. He revived upon bleeding at the Arm, and, being put to-bed, recovered his Senſes, and (as he ſaid) was perfectly eaſy, and free from Pain, except upon Coughing, which as often as he did, he ſpit Blood viſibly arterial from its florid Colour. About Four Hours after the Firſt Fit, he was taken with a Second, attended with the ſame Symptoms as the Firſt; and expired in it. Upon examining the Blood, which he brought up at his Death, I found, in Pieces of different Sizes, near Three Ounces of the Subſtance of the Lungs, not ulcerated, or any ways diſtempered; and I have Reaſon to believe there was near the ſame Quantity of the Lungs thrown up during the Firſt Fit of Coughing. The Pieces were eaſily diſtinguiſhable from grumous Blood, by their connecting Membrane, the *Acini* in the internal Part, and their ſpecific Gravity.

Upon examining the Contents of the *Thorax* after Death, the Right Lobes of the Lungs were ſound, of a good Colour, and no-ways injured: In the Left Cavity of the *Thorax*, there was a large Quantity of extravaſated Blood; the inferior Left Lobe adhered ſtrongly both to the *Pleura* and *Mediaſtinum*, and was ſomewhat decayed; but of the ſuperior Left Lobe, the upper Part next the *Trachea* adhered to the *Pleura* for about Two Inches; and the Remainder, where there had been no Adheſion, (as I could perceive from the ſmooth Surface of the *Pleura)* was torn away by Pieces, and diſcharged in Coughing. As the greateſt Part of the Left Side of the Lungs was tied down to the circumjacent *Membranes*, the Perſon being old, and the whole Force of the *Parietes* of the *Abdomen*, *Diaphragm*, &c. in the Action of coughing, was unequally exerted upon that Part that did not adhere, and which, by the Violence of the Preſſure, was torn off from the reſt, and diſcharged, as I juſt now mentioned; it is worthy Obſervation, how ſmall the Degree of Senſibility is in the Lungs; that a Perſon ſhould loſe ſo much of their Subſtance, as in this Inſtance, upon the Firſt Fit; and yet, upon Recovery of his Senſes, to complain of little or no Pain from ſuch Dilaceration, when even the Bite of an Inſect upon the Surface of the Body is attended with ſo much.

The Adheſion of this Man's Lungs explained likewiſe the Cauſe of his frequent Coughing for ſome Years before his Death.

# XIV. *An Account of ſeveral* Meteors, *communicated in a Letter from* Thomas Short, *M. D. to the* Preſident.

*Sheffield, March*
18. 1740-1.

*Honoured SIR,*

IF this Account of the following Meteors can either be of Uſe or Entertainment to the Members of your moſt Learned and Auguſt SOCIETY, I ſhall be glad. I am,

*Honoured SIR,*
*Your moſt obliged,*
*obedient humble Servant,*

Thomas Short.

THE Whole of 1737. having been the moſt irregularly conſtitute Year of any in my Time; not one Month but what had the Weather of all the Seaſons in it, and that not by gradual Tranſitions, but by ſudden Jerks; Summer was dry, *Auguſt* was as cold as Winter, *September* full of great Changes; hence that ſudden and general *Catarrh* in *October*; ſucceeded in the latter End of the Month, and all *November*, by a fatal *Diarrhœa* among the Poor. From *November* 29. to *December* 5. was mild and warm, cloudy and clear mixt, like Spring Weather; the Wind daily veering from South to North-weſt, and every Night falling back to South-weſt or South. *December* 5. at Five o'Clock at Night, the Sky round the Horizon was very cloudy, and clear in the *Zenith*; the Weſt Quarter was all of a deep Blood-red Colour, with Streamers of a very beautiful light red, not running or dancing with ſudden Occurſions and Mixtures, like the *Auroræ Boreales*, but waving like Vapours, toward the *Zenith*, by North-weſt to North: All the Clouds in the interim were of a very dark red Colour, except that in the Weſt, which was of a deep Blood-red. After it had continued ſome time there, the ſame appeared in the North. Under the Clouds, from whence theſe Streamers came, was a Brightneſs ſuperior to that of a Full Moon. Then both North and Weſt ſent forth their Blood-like Streamers, one toward the other, which paſſed one another, and came to their oppoſite Funds before they were quite ſpent. Between Seven and Eight at Night, the Scene ſhifted Eaſt; then that in the Weſt was exhauſted, and that in the North weakened: None of them ſent their Streamers beyond the *Zenith* to the South; only the Clouds in the South were of a very opaque Red. Laſtly, it removed South-eaſt, where the Remainder was ſpent: All was over about half an Hour after Ten. I had no Inſtrument to take its Altitude.

The chief Remarkables of this Meteor were,

1. From whatever Quarter theſe Streamers came, they iſſued out of a thick, deep-red Cloud, under which was hid ſo luminous a Body, that I could have eaſily read on a large Church Bible.

2. Theſe Streamers differed from thoſe of all preceding *Auroræ Boreales*: 1. That they were not white and clear, but a bright Red, like the Surface of ar-

arterial or pulmonary Blood. 2. They were not ſmall or narrow, but broad like the milky Way in a froſty Night. 3. They did not dart or fly ſwiftly from the Fund, or luminous Cloud, but moved ſlowly; then ſtood ſtill ſome Space of Time; then ſent out thin red Vapours, through which the Sky and Stars were viſible; theſe quickly ſpent themſelves, and vaniſhed. 4. Not only were their Funds red, but the whole Clouds were thick, and of a deep firy Red.

3. They were above the Region of the Winds; for, though the laſt was South-weſt, yet they moved from North to Weſt, as quickly as from Weſt to North.

4. Whilſt the Sky on the *Zenith* was of the common azure Blue, that in the South, on the Opening of the Clouds, was a deep bluiſh Green, like Graſs.

5. The whole Time was attended with an extraordinary Heat of the Air for the Seaſon; for I was obliged to ſtrip to the Shirt, though abroad in the Air all the time.

6. This Meteor was ſeen at *Venice* at the ſame time; and, over *Kilkenny* in *Ireland*, it appeared like a great Ball of Fire; which burſt with an Exploſion that ſhook great Part of the Iſland, and ſet the whole Hemiſphere on Fire; which burnt moſt furiouſly, till all the ſulphureous Matter was ſpent.

7. This Meteor put an End to the Remains of both the *Catarrh*, and watery *Diarrhœa*; and reſtored general Health, till the next epidemic *Catarrh* among Infants in *February* 1738. Two Months after.

The next Meteor was on *Auguſt* . 1733. a clear, calm, exceſſive hot Day, at Nine at Night, a frightful Glade of Fire, or *Draco Volans*, from Eaſt to Weſt.

*October* 1. 1736. Day cloudy, Wind SW. clear Evening, Six at Night, fell a great Ball of Fire out of the Air to the Earth, no Rain 15 Days before, and only a few Drops Two Days after.

*Auguſt* 28. 1738. Five *p. m.* Wind SW. Sky clear, the Sun bright ſhining, a firy Meteor appeared NE. ran North, like a Spear of Fire, with a great round Head, which burſt like a Rocket, ſpread about in a large Fire, and vaniſhed ſuddenly. This was a great Drought, which continued without Rain to *September* 7.

The next was *December* 2. 1739. Six at Night, Wind North, Sky clear, a white Froſt, a great *Halo* about the Moon. This Meteor appeared like a large round Body of Fire, of about a Foot and a half Diameter; ſeemed very low, therefore could not be obſerved far, though it went all over this Country from North to South, pretty ſharply, but nothing near ſo quick as a Glade of Lightning, was ſucceeded inſtantly by a moſt diſmal Sound in the Air, like Carts, Drums, and Groans mixt: It kept the Tract of the Meteor, but in an oppoſite Courſe, *viz.* from South to Weſt. This was a moſt frightful Time of Rains, Snow, Storms, *&c.*

As to *Auroræ Boreales*, the moſt remarkable were, 1. That of *September* 14. 1736. Wind North-weſt, Sky clear, next Day very rainy. This exactly reſembled a Crown nobly adorned with the richeſt Jewels; its concave Side facing the Weſt, and its convex reaching near the *Zenith*.

2. *September* 3. 1737. Wind NW. the Day was very rainy, and the Night a clear Froſt. About One in the Morning, was another *Aurora Borealis*, like a Crown,

its concave Side full of Streamers, ſeveral times red, had very ſwift Motions; but the ſplendid Crowns ſtood ſteady and fair Two or Three Hours. We find an Inſtance of the like over *Bohemia* in the *Philoſophical Tranſactions*.

The common late *Auroræ* were, 1736. *October* 16, 17, 18. Wind South, all Three Days ſhowery, the Nights bright and clear. *March* 10. 1737. Wind Weſt a Day and Rain, South at Night and clear. *September* 16. Wind Weſt, clear Night. 17. Wind Weſt, a Shower in the Day, and clear at Night. 19. 20. 21. Wind Weſt, all fair, ſome little Froſt. *October* 13. 14. Wind North, clear Days, froſty Nights; the 15th was much Rain. *March* 7. 1738. Wind South-weſt, Streamers reddiſh, Day cold and cloudy; the 8th was rainy; 30th, Air temperate, Wind NW. Day driſling, next Day fair and clear. *February* 4. 1739. Wind North-weſt, Day and Night clear; next Day ſnowy; 23, 24. both Days clear, Wind Weſt; the next Day good. *March* 1. Wind Weſt; that Night froſty, the next after clear and good. *September* 13, 14, 15. Wind North-weſt in the Morning, and South-weſt by South at Night; all Three Days ſhowery or driſling, Nights clear; 18, 19. Wind Eaſt, cloudy fair Days. *October* 22. at Night, Wind North, cloudy; appeared a frightful firy Dragon, ſeen over all *England*. This Month was the only good Weather from the 6th Day to the End, that this Country had that Harveſt. *November* 25. Wind North-weſt, cloudy Day, with a Shower, clear froſty Night, with *Auroræ Boreales*. The next I ſaw was on *October* 6. 1740. Wind Weſt North-weſt-by-weſt; Day clear, a ſmall Shower, a froſty Night. *February* 28. 1741. Wind North-weſt.

*March* 5. Wind South. 6th, Wind Weſt, then North. 9th, Wind South: All droughty Weather with ſmall Froſts.

To theſe Meteors I might add our Hurricanes, Storms of Thunder and Lightning, with Hail or Rain; but ſuch as keep Journals of the Weather, and read the public News, are no Strangers to theſe: I ſhall only add, that our Northern Lights have been much ſeldomer, and fainter, both in Appearance and Motion, than formerly; and whether they will dwindle away and vaniſh wholly for ſome Years, or whether they have had their former periodic Returns, is not certain: Nor is it leſs dubious, whether they affect our Weather, Seaſons, and Animal Bodies, or not. Were it not too tedious, I might here ſubjoin a Liſt of all the Chaſms or Burnings in the Heavens, recorded in our Annals.

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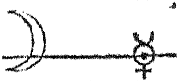
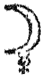
## XV. Mercurius *a* Venere *ſublatus* Maii 17. 1737. Grenovici *in Obſervatorio Regio obſervatus, per* J. Bevis, *M. D.*

| Horolog. Syder. | Horolog. Solare. | |
|---|---|---|
| 4. 20. 21. | . . . | Limbus Solis præcedens Merid. tranſit. |
| 22. 37. | . . . | Sequens limbus tranſit. |
| 34. 00. | 0. 13. 25. | |
| 35. 00. | 0. 14. 25. | |
| 5. 58. 48. | . . . | Limbus præcedens Veneris meridian. tranſit. Centro a vertice diſtan. {25. 46. 30.<br>25. 46. 41.} Mer- |

| Horolog. Syder. | Horolog. Solare. | |
|---|---|---|
| | | curium vero intra teleſcopium nequaquam conſpiciebam. |
| 5. 58. 48. | 9. 5. 5. | Mercurii centrum præcedentem Veneris limbum præibat 12″. temporis, in recta aſcenſione tubo 24 ped. micrometro inſtructo. |
| . . . | 9. 7. 16. | Repet. eodem tempore quo prius præibat. |
| . . . | 9. 28. 0. | Mercurio filum Micrometri parallelum decurrente, cuſpis auſtrina Veneris ab eodem filo abſcinditur  unde Venerem obtecturam Mercurium, vel ſaltem ſtricturam conjiciebam: micrometrum itaque extrahebam, quo melius inſtantem contactum diſcernerem. |
|  | 9. 44. 0. | Mercurius non plus diſtat a Venere quam decima parte diametri Veneris; deinde inimicæ nubes. |
| | 9. 52. 6. | Venus nitori proprio reſtituitur; Mercurius vero totus ſub Venere latet. Nubes deinde Venerem rurſus |

rurſus excipiunt, ulteriorem tam rari phænomeni contemplationem prohibentes.

J. Bevis.

*Maii* 18. *Grenovici.*

| Horol. Syder.— | Horol. Solare. | |
|---|---|---|
| 4. 24. 25.— | : : : | Limb. ☉ præced. merid. tranſ. inferiori diſt. a vertice 30. 4. 0. |
| 26. 42.— | : : : | Limb. ſequens tranſit. |
| 4. 38. 0.— | 0. 12. 50. | |
| 4. 39. 0.— | 0. 13. 50. | |
| 5. 57. 42.— | : : . | Limb. præcedens ♀ tranſ. merid. centro a vertice diſtant. $\left\{\begin{matrix}25. & 57. & 15.\\ 25. & 57. & 12.\end{matrix}\right\}$ |

Mercurium neque hac die videre licuit, cœlo licet admodum ſereno.

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## XVI. *An Occultation of* Aldebaran *by the* Moon, Dec. 12. 1738. p. m. *obſerved in* Fleetſtreet *with a reflecting Teleſcope of* 15 *Inches in Length, by Mr.* G. Graham, F. R. S.

| | |
|---|---|
| THE Occultation at : : | 5h. 27′. 6″. |
| Emerged at . . . . . | 5. 29. 59. |
| Duration . : . . . . | 1. 2. 53. |

The Sun's Tranſit at Noon at 11h. 59′. 52″. the Clock gaining of the mean Solar Time about One Second in a Day.

## XVII. *An* Eclipſe *of the* Sun, Dec. 19. 1739. *in the Morning, obſerved by Mr.* Short *in* Surrey-ſtreet, *with a reflecting Teleſcope of* 16 *Inches Focus, that magnified about* 40 *times.*

THE Beginning could not be ſeen for Clouds about the Horizon.

About 35′ after 8 o'Clock, there was an Opening, when the Sun ſeemed to be about 2 or 3 Digits eclipſed.

End was exactly obſerved at 9h. 1′. 45″. t. app.

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## XVIII. *An* Eclipſe *of the* Moon, Jan. 2. 1740. *obſerved at Mr.* Graham's *Houſe in* Fleet-ſtreet, *by Mr.* Short, *with a reflecting Teleſcope of Nine Inches Focus, that magnified about* 40 *times.*

| | | | |
|---|---|---|---|
| BEginning about . . . | 8h. | 25′. | 0″. t. app. |
| Beginning of total Darkneſs at . . . . . | 9. | 31. | 10. |
| End of total Darkneſs . . | 11. | 15. | 20. |
| End of the Eclipſe at . . | 12. | 22. | 0. |

*N. B.* The Beginning and End could not be diſtinctly ſeen for Clouds.

## XIX. *Some Things concerning* Electricity, *by the Rev.* J. T. Deſaguliers, *LL. D.* F. R. S.

ABOUT a Year or Two ago, in a Paper I gave in to the ROYAL SOCIETY *, I endeavoured to eſtabliſh ſome general Principles concerning Electricity, from the Conſideration of many Experiments, which have been tried by others, as well as ſome new Experiments by myſelf, an Account of which I then gave. Therefore I ſhall only now repeat my Diſtinction of all Bodies into Two Claſſes, in reſpect of Electricity, and make good the Definitions that I gave by ſome further Experiments; and though I do not pretend to know the Cauſe of Electricity in general, yet I hope from a few Laws of Electricity, deduced from known *Phænomena*, to ſolve moſt other *Phænomena*, (tho' ſeeming quite unaccountable) ſo far as to ſhew what Law of Electricity they depend upon; and to be able to foretel what will happen to moſt Bodies, before the *E*xperiments are tried upon them in an Electrical Way.

1. Bodies Electric *per ſe* are ſuch in whom a Virtue of attracting and repelling ſmall Bodies at a Diſtance is inherent, though it is not always in Action, ſo as to produce that Effect. But by rubbing, patting with the Hand, hammering, warming, and ſometimes only expoſing to dry Air, ſuch Bodies exert the Virtue above-mentioned; otherwiſe they are in a Non-electric State.

2. Non-electric Bodies are ſuch in which no Electrical Virtue can be excited by any Action upon the

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* See theſe *Tranſactions*, Nº 454.

Bodies themſelves, ſuch as rubbing, warming, &c But an Electric *per ſe*, when excited, can communicate its Virtue to a Non electric, and that Virtue will be received by all the Parts of the Non-electric, (be the Body ever ſo long, or large) and be ſtrongeſt, being, as it were, collected, at that End of the Non-electric, which is fartheſt from the Place where the Electricity is firſt received.

3. A Non-electric, having received Electricity, will communicate to another Body brought to touch it, or only brought pretty near, and that often with a ſnapping Noiſe, and a ſmall Flaſh of Light, loſing by that means all its own Electricity.

4. An Electric *per ſe* will become a Non-electric for a time, if it be made wet or moiſt, and become receptive of Electricity, which it will receive at one End, and carry to the other, where the Electricity will go off with a ſmall Exploſion, to impregnate any other Non-electric, which is brought near.

5. An Electric *per ſe*, in which Electricity has been excited, may become Non-electric by being expoſed to moiſt Air, whoſe humid Vapours it attracts; and then, brought to the Fire, or into very dry Air, recover its Electricity when the Moiſture is exhaled again.

6. An Electric *per ſe* may be made ſtrongly electric in Part of its Length, whilſt the other Part remains in a non-electric State.

7. A Body in a State of Electricity (whether a Non-electric having received Electricity, or an Electric *per ſe*, excited to Electricity) will attract all Non-electrics, and repel other Bodies that are in a State of Electricity, provided the Electricity be of the ſame kind.

8. A non-electric Body will not retain the Electricity which it receives from an Electric *per ſe*, unleſs it be free from touching any other non-electric Body; but muſt be ſuſpended or ſupported by Electrics *per ſe* touching only them and the Air.

9. An Electric *per ſe*, when it is not reduced to a non-electric State, will not receive Electricity from another Electric *per ſe*, whoſe Electricity is excited, ſo as to run along its whole Length; but will only receive it a little Way, being (as it were) ſaturated with it.

10. An Electric *per ſe* will not loſe all its Electricity at once, but only the Electricity of ſuch Parts of the Body as have communicated it to other Bodies, or near which Non-electrics have been brought.

11. When a Non-electric, which has received Electricy, communicates its Electricity to another, it loſes all its Electricity at once; and the *Effluvia*, in coming out, ſtrike the new Body brought near, as well as the Body firſt made electric.

12. Excited Electricity exerts itſelf in a Sphere round the Electric *per ſe*; or rather a Cylinder, if the Body be cylindric.

13. The Electricity which a Non-electric of great Length (for Example, a hempen String 800 or 900 Feet long) receives, runs from one End to the other in a Sphere of electrical *Effluvia*. But all the Supports of this String muſt be Electrics *per ſe*.

14. If this String be branched out into many Strings, the Electricity will run to all their Ends.

15. If the non-electric String, which is to receive and carry on the electric *Effluvia*, be not continuous, but has between its Ends ſome Electrics *per ſe*, the

*Effluvia* will ſtop at the firſt of them, unleſ
Interruption or Diſcontinuation of the Non-el
be ſhort; becauſe in that Caſe the Electricity ju
from the End of the firſt Non-electric to the Be
ning of the next, eſpecially if the Air be very
even though the Ends of the String ſhould be a
a Foot diſtant, and no Body but the Air betw
Sometimes indeed the Diſtance muſt not be abov
Inch or two.

There are Two Sorts of Electrics *per ſe*, know
what follows: A Body impregnated with Electr
from one Sort will repel all Bodies that have
Sort of Electricity, till they have loſt their
Electricity by coming to ſome Non-electric. B
Electric *per ſe* of the other Sort, though excited,
attract all thoſe Bodies, though in a State of R
ſion on account of the other Electricity; an
*vice verſa*.

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## XX. *An Account of ſome* Electrical Ex ments *made before the* ROYAL SOCI *on* Thurſday *the* 22*d of* January 174 *by the Same.*

IT being a Matter in Diſpute, whether the
any Difference between the Electricity of
and that of Gums and Reſins, I made the follo
Experiments, in order to ſettle that Point:

I faſtened a String of dry Cat-gut (which, whe
is an Electric *per ſe*) from one Pillar to the oth
the End of the Table in the Meeting-Room

ROYAL SOCIETY, about Seven Feet from the Floor; and to the Middle of that Cat-gut faſtened a ſilken Thread about Two Foot long, which hung down, and at its lower End had a Down Feather. Then rubbing the End of a Stick of Wax pretty quick and ſtrongly againſt my Waiſtcoat, which was made of Cloth, the Wax became electrical, and attracted the Feather, which ſtuck to it awhile, and then was repelled from it, as long as it retained the Electricity it had received from the Wax: But, having touched the Feather with my Finger, it loſt its Electricity; and, becoming a Non-electric, was again attracted by the Wax, which gave it freſh Electricity; and then it was repelled from it, and ſo *toties quoties*. When the Feather was in its electric State, I applied to it another Stick of Wax, which I firſt rubbed; and it repelled the Feather, though it had not touched it before, and did the ſame as the other Stick of Wax had done.

After that I rubbed a glaſs Tube, which firſt attracted and then repelled the Feather, as the Wax had done: And another Tube, being rubbed, repelled the Feather, when it was put into an electric State by the firſt Tube, without firſt attracting it. But Non-electrics, ſuch as the Finger, or a Stick, attracted the Feather, when it had firſt been made electric; and not only ſo, but Electrics *per ſe*, when they were become non-electric, as the Tube unrubbed, or the Wax unrubbed; nay, the rubbed Tube alſo, when its End was moiſtened, or that End of it turned to the Feather, which had been held in the Hand.

Then I made the Feather electric, by the Application of the excited Tube; and, having rubbed the

Wax to give it Electricity, I brought it near the Feather, which it attracted ſtrongly, though it had repelled it before, when the Feather had been made electric by Wax.

Afterwards I made the Feather electric by the Wax, which firſt attracted and then repelled it: And, having applied the rubbed Tube to the Feather, it attracted it ſtrongly, though it repelled it when the Feather was made electric by another glaſs Tube.

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## XXI. Electrical Experiments *made before the* ROYAL SOCIETY, *on* Thurſday, March 15*th* 1740-1. *by the Same.*

HAving ſhewn lately by ſome plain Experiments, that the Electricity of Glaſs is different from that of Sealing-wax; becauſe the Wax attracted a Feather ſuſpended in the Air by a fine Silk, when the rubbed glaſs Tube repelled it, (as deſcribed in the Account of thoſe Experiments) I made the Experiment with a Cake of Roſin inſtead of Sealing-wax; and it appeared to have the ſame kind of Electricity as the Sealing-wax. Then conſidering that the Supporters of any non-electric Conductors of Electricity muſt themſelves be electric, I had a mind to try whether Bodies, endued with either kind of Electricity, were in any-wiſe different in that Caſe; which I did by the following Experiments:

I laid a Piece of Wood, Four Foot long, on Two glaſs Plates, whoſe Ends ſtood One Foot beyond the Side of the Table on which they were laid: Then, ap-

Wind, that the valvular Corrugations in both almoſt totally diſappeared.——Yet exactly at the *Valvula Tulpii, alias Bauhini*, there was a very great Conſtriction of the inteſtinal Canal, as if tied ſtrongly with a Cord; and, though we opened the *Colon* about a Hand's-breadth beyond the *Valve*, and let out the *Flatus*, we could not poſſibly preſs any Wind from the *Ilium* into the *Colon* through the *Valve*.——I ſuſpected indurated Excrement, as an Obſtacle; but, on a careful Inquiry, only found the whole valvular Production, and the End of the *Ilium*, at its Inſertion into the *Colon*, highly inflamed, and quite ſhutting up the Paſſage.——On dilating the Rings of the oblique and tranſverſe Muſcles, the Wind rumbled up out of the *Ilium* into the Cavity of the Belly very readily.——We found pretty much bloody *Sanies* in the Guts, on ſlitting them open, but little or no indurated *Fæces*: A manifeſt Proof, that the exceeding Hardneſs of the Tumour was owing only to the exceſſive Flatulence, and great Inflammation; and ſhews how much we may be deceived in our Conjecture on like Occaſions.——The Tumour of the *Scrotum* was 28 Inches round.——I was much ſurpriſed to find no Adheſion of the *Inteſtines* to the containing Parts, though he had ſo long laboured under the *Hernia*.

This unhappy Caſe gave me a ſevere Reflection, and I cannot but think the Malady was much increaſed by the repeated Application of the hot Fomentations; as it rareſied the Air greatly, and, by relaxing the Parts, gave further Room to the vaſt Expanſion.——At that time I had never ſeen *Belloſte*'s Second Part to his *Hoſpital-Surgeon*, where he adviſes, in

ſuch

may be of ſome Uſe in Practice: Therefore I ſend it firſt.

Mr. *Burman*, a Taylor of this Town, about 40, had from his Childhood laboured under a ſmall inguinal Rupture on the Right Side; but about Six Years before his Death, from a Blow received in his Groin, the *Hernia* became very large, and the Gut always remained down in the *Scrotum*; for he wore no Bag, Truſs, or the like, to ſupport it.——The Day before his Death, he was following his Work, as uſual, with his Preſſing-iron, without any violent Jerk, or Straining; but, about 10 in the Morning, all at once, he felt a very great Pain in his Right *Inguen*; which, continually increaſing, in Two or Three Hours threw him into Vomitings, cold Sweats, *&c.* ——His Apothecary, Mr. *Ellery*, gave him a Clyſter, which brought off a ſmall matter of thin Stool; but gave no Relief, though it had been formerly very ſerviceable to him in the like Diſorder.——About Eight in the Evening I was ſent for, and found him in cold Sweats, with ſcarce any Pulſe: The *hernial* Tumour was prodigious large, and exceeding hard; the Pains extremely violent, which cauſed exceſſive Languors.——I immediately ordered, that he ſhould be placed in a proper Poſture, that a warm aromatic emollient Fomentation ſhould be frequently and long applied, and that a Reduction of the Inteſtine ſhould be attempted; or, if that did not ſucceed, that the Operation for the *Bubonocele* ſhould be performed. ——The Fomentation was tried a long while, emollient *Terebinthinate* Clyſters injected, and the Reduction attempted, for an Hour or Two, by Mr. *John Start*, a skilful Surgeon, but in vain: Nay, the Swelling

ing increaſed conſiderably during the Application; and the Pain became (if poſſible) more aggravated all over the *Hernia*, which before was chiefly at, and near, the Rings of the *Abdominal* Muſcles; and this too, though he took, with an eaſy Cordial, and mulled Wine, *Laudan. Solid. gr.* ij *3tiis Horis.*——Early the next Morning I was deſired to ſee him again; and, finding that he had not ſlept a Moment, the Tumour conſiderably increaſed, and exceſſive hard, though not diſcoloured, and the Patient exceeding weak and pained, I adviſed the Operation forthwith, as the only poſſible Means of ſaving him: But he was unwilling to admit of it, and we were all indeed diffident of the Succeſs.——Whilſt a freſh Fomentation was getting ready, the poor Man expired in Agonies.——About an Hour or Two after, we opened the *Scrotum*, which in ſo ſhort a Space of Time appeared all livid, and the Blood-veſſels were extremely turgid and varicoſe.——Upon cutting through the Teguments, Part of the *Colon* and *Ilium* thruſt out with great Force: they were both prodigiouſly diſtended with Wind, highly inflamed, and in ſeveral Places very livid.——That Part of the Guts commonly called *Cæcum*, was blown up into a kind of globular Figure, as big as a Child's Head.——It was remarkable, whether in the original Conformation, or by the vaſt Diſtention, I know not, that there was no manner of Appearance of the *Appendix vermiformis* to be found, though we diligently examined:——And further, that the *Cæcum* was vaſtly thicker ſet with Glands, and they much larger, than I had ever ſeen before in any Subject.——The Convolutions of the *Ilium* and *Colon* were ſo immenſly diſtended with

Wind, that the valvular Corrugations in both almoſt totally diſappeared.——Yet exactly at the *Valvula Tulpii, alias Bauhini*, there was a very great Conſtriction of the inteſtinal Canal, as if tied ſtrongly with a Cord; and, though we opened the *Colon* about a Hand's-breadth beyond the *Valve*, and let out the *Flatus*, we could not poſſibly preſs any Wind from the *Ilium* into the *Colon* through the *Valve*.——I ſuſpected indurated Excrement, as an Obſtacle; but, on a careful Inquiry, only found the whole valvular Production, and the End of the *Ilium*, at its Inſertion into the *Colon*, highly inflamed, and quite ſhutting up the Paſſage.——On dilating the Rings of the oblique and tranſverſe Muſcles, the Wind rumbled up out of the *Ilium* into the Cavity of the Belly very readily.——We found pretty much bloody *Sanies* in the Guts, on ſlitting them open, but little or no indurated *Fæces*: A manifeſt Proof, that the exceeding Hardneſs of the Tumour was owing only to the exceſſive Flatulence, and great Inflammation; and ſhews how much we may be deceived in our Conjecture on like Occaſions.——The Tumour of the *Scrotum* was 28 Inches round.——I was much ſurpriſed to find no Adheſion of the *Inteſtines* to the containing Parts, though he had ſo long laboured under the *Hernia*.

This unhappy Caſe gave me a ſevere Reflection, and I cannot but think the Malady was much increaſed by the repeated Application of the hot Fomentations; as it rarefied the Air greatly, and, by relaxing the Parts, gave further Room to the vaſt Expanſion.——At that time I had never ſeen *Belloſte*'s Second Part to his *Hoſpital-Surgeon*, where he adviſes, in ſuch Caſes, the moſt cold aſtringent Fomentations. ——In this and the like, they might have been very proper; eſpecially if a Portion of Spirit of Wine camphorated had been added to prevent Mortification.

It ſometimes happens, that though the annular Perforations of the abdominal Muſcles are dilated by the Operation, yet the *Hernia* cannot be reduced.—— I believe, as the Guts were diſtended to ſo enormous a Bulk in this Man, it would have been impracticable. In ſuch Caſes may it not be proper to prick them with a Needle, to let out the *Flatus*, as is commonly practiſed in ſmall Wounds of the *Abdomen*, where the *Inteſtine* thruſts out, and becomes ſo turgid with Wind, that it cannot otherwiſe be returned?—— In ſome ventral Ruptures (as they are called) this alſo may be neceſſary.——I find Mr. *Sharp*, in his late excellent Piece of Surgery, approves of this Method, from an old *Engliſh* Practitioner, who had often uſed it with Succeſs.——I am perſuaded, Punctures in this Manner are much leſs dangerous than the Operation; and believe, in ſuch Caſes, may be more effectual.—— It is a common thing with Graſiers and Cattle-Doctors, to prick the Guts of their Sheep and Bullocks with great Succeſs, when, by feeding on Clover, or freſh young Graſs, their Guts become ſo vaſtly diſtended with Wind, as would otherwiſe certainly kill them.——May not a very ſmall hollow Needle with Perforations, as in that uſed by ſome inſtead of the *Trocar* for a *Paracentheſis*, be more proper than a common Needle?——May not the hernial Tumour be perceived to be chiefly flatulent by its being in ſome Degree tranſparent upon applying a Candle, as uſed in the *Hydrocele*? And may not that direct the proper Place for Punctures?

Theſe are Conjectures; but I am, with great Truth, and the higheſt Reſpect,

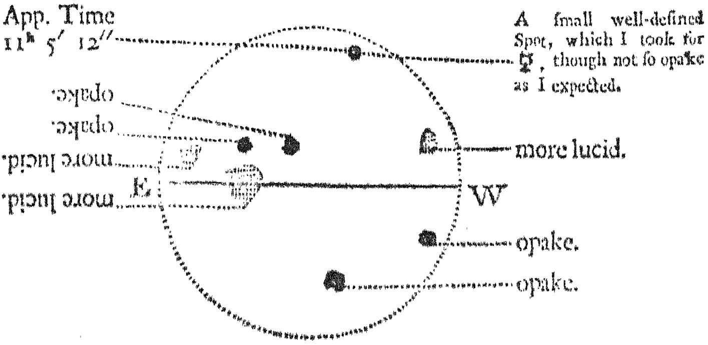
*SIR*,

*Your moſt obliged,*
*and moſt obedient,*
*humble Servant,*

Plymouth, June 8. 1739.

**J. Huxham.**

I have taken the Liberty to fill up this Letter with a Scheme of the Phaſe of the Sun, *October* 31ſt, 11h. 5′. 12″. as taken by my Teleſcope, which is a very good one of 10 Feet; but as I had neither Croſs-Hairs, Micrometer, or other exact Inſtruments, the Obſervation may not be very exact: Beſides, I had only a Glimpſe of the Sun for 7 or 8 Minutes.



A ſmall well-defined Spot, which I took for ☿, though not ſo opake as I expected.

## XXIII. *An Obſervation on the Planet* Venus, (*with regard to her having a* Satellite) *made by Mr.* James Short, F.R.S. *at* Sunriſe, October 23. 1740.

DIrecting a reflecting Teleſcope of 16.5 Inches Focus, (with an Apparatus to follow the diurnal Motion) towards *Venus*, I perceived a ſmall Star pretty nigh her; upon which I took another Teleſcope of the ſame focal Diſtance, which magnified about 50 or 60 times, and which was fitted with a Micrometer, in order to meaſure its Diſtance from *Venus*; and found its Diſtance to be about 10″. 2′.0″. Finding *Venus* very diſtinct, and conſequently the Air very clear, I put on a magnifying Power of 240 times, and, to my great Surprize, found this Star put on the ſame Phaſis with *Venus*. I tried another magnifying Power of 140 times, and even then found the Star under the ſame Phaſis. Its Diameter ſeemed about a Third, or ſomewhat leſs, of the Diameter of *Venus*; its Light was not ſo bright or vivid, but exceeding ſharp and well defined. A Line, paſſing through the Centre of *Venus* and it, made an Angle with the Equator of about 18 or 20 Degrees.

I ſaw it for the Space of an Hour ſeveral times that Morning; but the Light of the Sun increaſing, I loſt it altogether about a Quarter of an Hour after Eight. I have looked for it every clear Morning ſince, but never had the good Fortune to ſee it again.

*Caſſini*, in his Aſtronomy, mentions much ſuch another Obſervation.

I likewiſe obſerved Two darkiſh Spots upon the Body of *Venus*; for the Air was exceeding clear and ſerene.

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## XXIV. *An Occultation of* Jupiter *and his* Satellites *by the* Moon, October 28. 1740. *in the Morning; obſerved at Mr.* George Graham's, F. R. S. *Houſe in* Fleetſtreet, London, *by Dr.* Bevis *and Mr.* James Short, F. R. S.

| Times by the Clock, *October* 26. Clock above Stairs. | Apparent Times. *October* 27. | |
|---|---|---|
| h. ′. ″. | h. ′. ″. | |
| 23. 46. 38. | 0. 0. 0. | THE Sun's Centre paſſed the Meridian in the Tranſitory. |
| Clock below. | | |
| 14. 49. 4. | 15. 2. 25. | The Moon's illuminate Limb preceded *Jupiter* in Right Aſcenſion 1′. 38″. in time. |
| 14. 52. 32. | 15. 5. 53. | The ſame Limb preceded *Jupiter* 1′. 31″. |
| | | Theſe were taken with a reflecting Teleſcope, 9 Inches |

| h. ′. ″. | h. ′. ″. | |
|---|---|---|
| | | 9 Inches Focus, fitted with Wires at half Right Angles, and which magnified 30 times. |
| Clock above. | | |
| 15. 26. 1. | 15. 39. 20. | *Sirius* paſſed the Meridian. |
| 15. 37. 43. | 15. 51. 2. | The Moon's Centre paſſed the Meridian. |
| 15. 39. 9. | 15. 52. 28. | *Jupiter*'s Centre paſſed the Meridian. |
| Clock below. | | |
| 15. 41. 15. | 15. 54. 36. | *Jupiter's* Third *Satellite* eclipſed by the Moon. |
| 15. 47. 10. | 16. 0. 31. | *Jupiter*'s Second *Satellite* eclipſed by the Moon. |
| 15. 53. 4. | 16. 8. 25. | *Jupiter*'s preceding Limb immerged. |
| 15. 57. 20. | 16. 10. 41. | *Jupiter*'s ſubſequent Limb immerged. |
| 16. 0. 54. | 16. 14. 15. | *Jupiter*'s Firſt *Satellite* eclipſed by the Moon. |
| | | Theſe Immerſions were taken with a Reflecting Teleſcope, of 16.5 Inches Focus, that magnified 120 times. |
| Clock above. | | |
| 16. 17. 49. | 16. 31. 8. | *Procyon* paſſed the Meridian. |
| *October* 27. | *October* 28. | |
| 23. 46. 42. | 0. 0. 0. | The Sun's Centre paſſed the Meridian. |

*N. B.* The Clock in the lower Room was all along 2″ ſlower than the Clock in the upper Room.

None of the Emerſions could be ſeen for Clouds. Whilſt *Jupiter* was immerging, the Sky was perfectly ſerene; and, at his neareſt Approach to the Moon, he did not appear to alter his Figure in the leaſt, nor to be tinged with any priſmatic Colours; neither did he (as is ſaid to have been ſometimes obſerved through refracting Teleſcopes) ſeem to enter at all upon the Moon's Body.

That Part on the Moon's Limb where *Jupiter* entered, was a Hollow; and though ſome are of Opinion, that the Circumference of the Moon, as it is bounded to our Eye, is a perfectly ſmooth Circle, and that no Hills or Hollows appear there, as on the Surface of the Moon; yet if it be looked at in a clear Night with a good Teleſcope, that magnifies about 100 times, or even leſs, it will be ſeen rugged and uneven all round.

Notwithſtanding *Jupiter*'s Light ſeems to be more vivid than that of the Moon, when he is ſeen at a good Diſtance from her, and far more ſo when the Moon is away; yet the contrary is plainly diſcerned when they are near one another: And in this Obſervation, whilſt *Jupiter* was immerging behind the Moon, his Disk appeared much dimmer, and of a more faint and dusky Complexion, than the Disk of the Moon.

## XXV. *A Letter from* James Parſons, *M. D.* F. R. S. *to the* ROYAL SOCIETY, *giving a ſhort Account of his Book intituled* A Mechanical Critical Inquiry into the Nature of *Hermaphrodites.* London, 1741. *in* 8vo.

GENTLEMEN,

AS the Compaſs of Nature is the utmoſt Boundary of any certain Knowledge we can arrive to in this Life, the Diſcovery of Truth by our Inquiries made into the Myſteries of Nature, muſt afford the greateſt Satisfaction.

Phyſical Knowledge ought much more to be the Subject of every one's Contemplation then, as yet, it ſeems to be; being moſt conducive to publick Welfare, and to furniſh the Minds of Men with the juſteſt Notions of the great AUTHOR of Nature: Elſe why do learned Societies ſo aſſiduouſly aſſemble? Why endeavour ſtill to add more Grains to their former Knowledge? but becauſe (alſo) the Study of Nature is the only pleaſing and ſmooth Field for the inquiſitive Soul to range in; a Field whoſe Objects are capable of being ſeized by our proper Senſes, and whoſe *Phænomena* may, by due Application, come within our Reaſon.

Such a Society then are the beſt Judges, and fitteſt Protectors, of every Eſſay oppoſed to vulgar Errors. 'Tis therefore I took the Liberty of dedicating this my Inquity into the Nature of *Hermaphrodites* to you, which the Preſident, Vice-Preſident, and others of you, were ſo kind to ſay, would not be unacceptable; eſpecially as it was wrote at a Time when the Town was daily entertained with Advertiſements of the *Angolan* that was ſhewed here publickly, and, thereby, was almoſt in general allured into the ſame Error that moſt of the Nations upon Earth had implicitly run after, from the Beginning of the World, concerning them; who were led into it by no leſs than the Writings of their moſt learned Men.

In order, Gentlemen, to give you, in ſome meaſure, a View of the Deſign of this little Book, I am to inform you, that the general Opinion of the World is, that there are *Hermaphrodites* in human Nature. In this Treatiſe I am to ſhew it cannot be; which I have endeavoured to do in the following Method, *viz.*

1. The Introduction, which is chiefly hiſtorical, lays down the Manner of this Error's being propagated amongſt *Jews*, *Pagans*, and *Chriſtians*, at all Times; with an Account of *Jewiſh*, Civil, and Canon Laws made againſt ſuch as were reputed *Hermaphrodites*, as well as thoſe that were always in Force at *Rome*, by which great Numbers of People were deſtroyed from time to time.

2. The Firſt Chapter exhibits many Reaſons againſt a Poſſibility of their Exiſtence in human Nature; with a true Diſcovery of ſuch Diſeaſes as have been the Cauſe of Men and Womens being called *Hermaphrodites*.

3. The Second Chapter is a critical Account of the Cauſes Authors have aſſigned for the Produce of *Hermaphrodites*; wherein it is proved, that no ſuch Effects could ariſe from thoſe Cauſes; and ſeveral

Ab-

Abſurdities are expoſed in the Arguments advanced for the Support of this Error.

4. The Third Chapter is a critical View of the Hiſtories of *Hermaphrodites* given by ſeveral Authors; ſhewing that thoſe ſo reputed were either perfect Men or Women, having only ſome Deformity or Diſeaſe in the Parts of Generation.

5. The Concluſion deſcribes the State of all Female *Fœtuſes*, with ſome Obſervations which I laid before this moſt Honourable SOCIETY; which prove that every Female *Fœtus* may as well be thought an *Hermaphrodite*, as any that were ever called ſo.

By this Method I hope it will appear, that this ſo long reigning Error is confuted; and if this Learned SOCIETY, whoſe ſole Buſineſs here is to inſpect into the true Nature of Things, think I have ſucceeded, and give this Treatiſe, which I have the Honour to preſent them, a favourable Reception, it will be eſteemed a very great Honour by their

*Moſt obedient Servant,*

J. Parſons.

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## XXVI. *An Account of an* antient Date *in* Arabian Figures, *upon the North Front of the Pariſh Church of* Rumſey *in* Hampſhire. *By the Rev. Mr.* William Barlow.

AS the knowing how long the *Arabian* or *Indian* Figures have been uſed in the Weſt, may ſometimes be a means for diſtinguiſhing ſpurious from genuine Dates; ſo a wrong Hypotheſis—fixing the Time later than it ought to be—may poſſibly induce us to ſuſpect genuine Dates to be doubtful or ſpurious. To give ſome Light to this Subject, I have here ſent a Draught of Part of the North Front of the Abbey (now Pariſh) Church of *Rumſey*, in the County of *Southampton*, with an Inſcription on the ſame. That this Inſcription is a Date, 1011, is evident from the Figures. That it is a genuine Date, the apparent Antiquity of the Building plainly demonſtrates. A ſpurious Date in this Place would have expreſſed the Time when the Abbey was founded by King *Edward*, Grandfather of *Edgar*, above a Hundred Years before the Time here mentioned.

There is ſomething very remarkable with relation to the Time when this Church was built. Not only during the Year of this Date, 1011, but for ſeveral Years before, many Parts of *England* were laid waſte by the revenging *Danes*, juſtly incenſed againſt the *Engliſh* by the inhuman Maſſacre of their Countrymen in the Year 1002. The *Saxon* Chronicle, *p.* 141. acquaints us, that the County of *Hants*, Hamꞇun-ꞅciꞃe, among others, was miſerably harraſſed by theſe cruel Invaders this Year of the Date *. It is thereſore very extraordinary, that ſo fine a Pile (according to the Age when it was built) ſhould be raiſed at a time when every thing elſe, Sacred and Civil, was plundered and deſtroyed by theſe mercileſs Ravagers. But probably the Devaſtation was not quite ſo general as repreſented.

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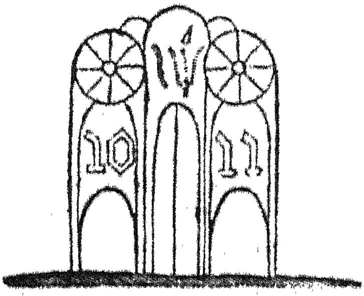
* *Florence* of *Worceſter* alſo obſerves the ſame. . . *Suthamtonenſi, Wiltunenſi . . . provinciis . à Danorum exercitu ferro flammaque demolitis. Ad An.* 1011. *p.* 613.

If this be a genuine Date, (and I ſee no Reaſon to queſtion it) it is, I believe, the antienteſt, *Indian*, or other, that has yet been taken notice of in *England*, perhaps in *Europe*; and quite deſtroys the Opinions advanced by *Scaliger*, *Voſſius*, *F. Mabillon*, Dr. *Wallis*, and other learned Men, concerning this Matter.

Now I have mentioned this Abbey of *Rumſey*, I take Leave to correct an Error in Sir *H. Savil*'s (the only extant) Edition of *Roger Howeden*, *Frankf.* 1601. *p.* 426. *Anno* 967. *Rex . . Edgarus in Monaſterio* Rameſeie, *quod Avus ſuus Edvardus ſenior conſtruxerat.*—Here it is called *Rameſeie*, by Miſtake, for *Rumeſeie*; and again in the ſame Page. But *Rameſeie* was *Ramſey* in the County of *Huntington*, a Monaſtery founded by *Oſwald*[*] Biſhop of *Worceſter*, afterwards Archbiſhop of *York*, conſecrated by the ſaid *Oſwald An.* 991[†]. This Identity of Name, unobſerved, may occaſion great Confuſion in the Hiſtory of theſe Two Places. I find *F. Creſſy* (*p.* 860.) or the Authors he tranſcribed from, miſled by this typographical Error. Poſſibly others may fall into the ſame Miſtake, by the ſame Means. It is pity there is not a more correct Edition of that Author.



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[*] *Will. Malmeſb. De Geſt. Reg. Ang. p.* 56. 291.

[†] *Simeon Dunelm. ad An.* 991.

XXVII. *Some*

## XXVII. *Some Obſervations concerning the* Virtue *of the* Jelly *of* Black Currants, *in curing* Inflammations *in the* Throat. *By* Henry Baker, F. R. S.

SINCE Providence has been pleaſed to beſtow certain medicinal Virtues on many Animals, Vegetables, and Minerals, which, in particular Caſes, may be highly ſerviceable to the Health of Mankind; when ſuch Virtues are happily diſcovered, they ſhould be made as generally known as poſſible, that all may partake the Benefit.

No farther Apology need be offered to this illuſtrious Society, for communicating a ſhort Account of the ſpeedy Relief myſelf and many others have frequently received, in a very troubleſome and often dangerous Diſorder, by the particular Virtue and Efficacy of a Shrub, well known amongſt us, though commonly but little regarded.

From my Childhood, till within about Twelve Years paſt, I uſed, almoſt conſtantly, upon taking Cold, to be ſeized immediately with an Inflammation in the Throat, attended with great Swelling, Throbbing and Soreneſs: And notwithſtanding Bleeding and Purging, together with the Aſſiſtance of Gargles, Linctus's, and all the other Methods generally made uſe of in ſuch Caſes, it moſt commonly would take its Courſe; that is, in about a Week or Ten Days time, it would ſuppurate and break, a conſiderable Quantity of fetid Matter would be diſcharged, and then I ſoon recovered.—During its Continuance, I was unable to ſwallow any thing but warm Liquids, and even thoſe not without much Difficulty and Pain; but upon its breaking I found immediate Eaſe.

This Diſorder attacking me Five or Six times a Year, and ſometimes oftener, afforded but too frequent Opportunities of experiencing, that all the common Methods did me no Good at all; but, on the contrary, made my Uneaſineſs laſt the longer, by retarding the Suppuration: Which often determined me to leave it wholly to Nature, with the Aſſiſtance only of warm Broths and Gruels.

But, about Twelve Years ago, I became acquainted with a learned and ingenious Clergyman, the Rev$^{d}$ Mr. *Waſhbourne*, Vicar of *Edmonton*, and one of the Canons of *St. Paul's*; who told me, that from many Experiments on himſelf and others, ſcarce ever failing of Succeſs, he could almoſt aſſure me of a certain Cure, if, as ſoon as ever I ſhould perceive any Swelling or Soreneſs in the Throat begin, I would ſwallow, leiſurely, a ſmall Quantity of the Juice of *Black Currants* * made into a Jelly; or, if the Jelly could not be got, a Decoction of the Leaves in Milk, or even of the Bark (if it ſhould happen in Winter), uſed by the way of Gargle, would prove, he ſaid, a Specific for all inflammatory Diſorders of the Throat.

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* *Ribes nigrum*, Raii *Hiſt. Plant.* Vol. II. p. 1486. SQUINANCY BERRIES: *Anginæ utiles* [*baccas*] *eſſe nomen Anglicum arguit.*

Dale *in* Pharmacologia *ſua in 4to. p.* 293. (*ait*) *Ribes nigra in angina commendatur.*

*John Aubrey*, Eſq; F. R. S. in his Miſcellanies, printed at *London*, 1721. in 8vo. p. 63. ſays, that a Gentlewoman had her ſore Throat cured by a Pulteſs of *Blue Currants*.

The Efficacy of the Jelly of *Black Currants*, in curing ſore Throats, has been long known among ſeveral good Women, who give away Medicines in the Country; yet it has been hitherto ſo overlooked by Phyſicians, as not to be ordered to be kept in the Apothecaries Shops; and even the *Rob* or Jelly of *Elder-berries*, which comes up to this next in Virtue, although ordered, is kept but in few Shops. *C. M.*

Though I had no great Faith, I reſolved to try this eaſy Remedy: And, as ſoon as *Black Currants* could be got, cauſed a Quantity of their Jelly to be made: Nor was an Occaſion of trying it long wanting, when, to my great Surprize and Joy, I found its Effect beyond any thing I could imagine; for in Two or Three Hours the Inflammation and Swelling intirely vaniſhed, and my Throat remained as eaſy as if nothing at all had happened.

From that time till very lately, for a Dozen Years together, this Medicine has never failed me once: But has, on numberleſs Trials, taken away this Diſorder from me in a few Hours. It has likewiſe had the ſame good Effect on many of my Friends, to whom I have at different times recommended it, ſo that ſeveral of them are never now without it in their Houſes.

But a Diſappointment I lately imagined I had met with from this Medicine, is the Reaſon of my laying before you the following Fact.

Upon taking Cold, about Ten Weeks ago, I was ſeized with an Inflammation in my Throat, attended with Soreneſs, and throbbing Pain; on which I applied to my old Remedy, but without the uſual Succeſs; for though I took it ſeveral times a Day, for Two or Three Days together, the Diſorder grew continually worſe, and the Left Side of my Throat was ſo violently inflamed and painful, and ſwelled to ſuch a Degree, that I was not able to ſwallow even Liquids without abundance of Trouble. In ſhort, it exactly reſembled the ſore Throats I uſed to be afflicted with before my Knowledge of this Medicine; and therefore I gave it up to take the ſame Courſe it was accuſtomed to do formerly.

After about a Week, when I had good Reaſon to believe there was a conſiderable Collection of Matter, and I expected it every Hour to break, I was called by Buſineſs to a Relation's Houſe at *Tottenham*, in *Middleſex*; where, being ſcarce able to get down a ſingle Diſh of Tea, my Friends (who have been long acquainted with the Virtues of *Black Currant Jelly*) inquired wherefore I had not applied to my uſual Remedy: I told them, that I had, but to no purpoſe at all; which I knew not how to account for, unleſs, mine being above Two Years old, Time had deſtroyed its Virtue. They ſaid, they had lately made ſome; and immediately fetched a Glaſs of it, which they perſuaded me to make uſe of.—I took Three or Four Spoonfuls of it, rather through Civility, than from any Hope of its doing Good, at a time when I every Moment expected and wiſhed it to break.

In about an Hour's time, as I ſat by the Fire-ſide, I perceived a ſort of diſagreeable putrid Smell, which I did not mind at firſt, ſuppoſing it ſomething accidental: But, finding a Continuance or rather an Increaſe of it, I began to examine what it might be owing to; and was convinced, after I had changed my Place, that it proceeded from myſelf, and was really the Smell of my own Perſpiration, which I found ſo much increaſed, as to become almoſt a Sweat. At the ſame time, fancying my Throat a little eaſier, I took ſome more of the Jelly.

I came to *Tottenham* about Five in the Afternoon, and began with the Jelly about Six. At Supper I with ſome Difficulty got down a little Gruel; and when I went to-bed, drank ſome Linſeed-tea, ſweetened with Syrup of Mulberries.—I ſoon got to ſleep; but, waking after ſome Hours, found myſelf in a gentle breathing Sweat, attended with the ſame unpleaſant putrid Smell. The Swelling in my Throat was, however, ſenſibly diminiſhed, and the Soreneſs much abated: At which being rejoiced, I took a Mouthful of the Jelly that ſtood by my Bedſide, and compoſed myſelf to ſleep again. A gentle Sweat continued during the whole Night; and, in the Morning, the Swelling, to my great Amazement, was quite reduced, and the Soreneſs ſo inconſiderable, that about Ten o'Clock I eat ſome Toaſt with Chocolate, and by Dinner-time had no more Remains of any Diſorder than if it had never been.

I am very certain the Swelling was not diſcharged by breaking; for had it broke, even in my Sleep, I muſt have found ſome ill Taſte in my Mouth at waking: Whereas I was not ſenſible of any diſagreeable Taſte at all, but the Smell before-mentioned was greatly offenſive to me, whenever I put my Noſe into the Bed.

During the whole Time I have been ſpeaking of, that is, for about Seventeen Hours, I made Water but once only, and then in a ſmall Quantity: The Colour of it was very high, and it ſoon threw down an exceeding thick Sediment, as did all I made for Two Days afterwards, though gradually clearing up more and more.

I ſhall not preſume to offer any Opinion as to the Manner this Medicine operates, but leave it to be conſidered by more proper Judges; only permit me to obſerve, that were the Virtues of Simples diligently inquired into, we might perhaps diſcover more ready and certain Cures for ſome Diſtempers than what we know at preſent. The barbarous *Negroes*, merely by Trials and Obſervations, have been able to find out both Poiſons and Counterpoiſons, on which (if our Accounts of them be true) they can depend with Certainty: And we know, that the Savages in *America* have diſcovered by the ſame Means, and generouſly taught us, the medicinal Effects of their *Ipecacuanha*, *Contraverva*, *Peruvian Bark*, and ſome other Simples, which are almoſt infallible in curing the Diſorders of the Climate where they grow: Nor is it improbable, that every Country may produce Remedies for the Diſeaſes of its Natives.

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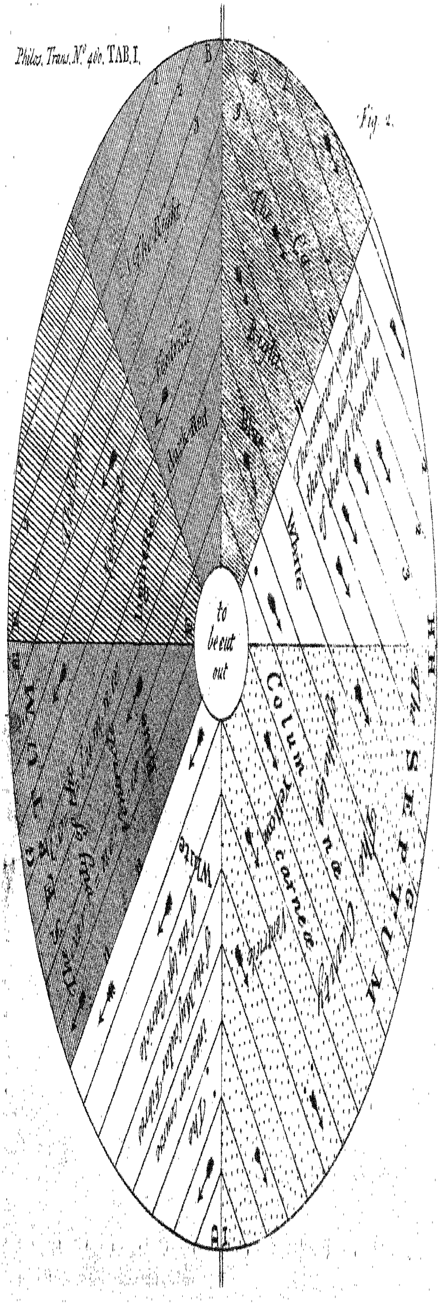
*N. B.* Dr. *Jurin's* Diſſertations were firſt printed thus:
Diſſ. 1. . . in *Tranſactions*, Nº 355.
2. . . . . . . . . . 363.
3. . . in *Comment. Acad. Petrop.* Tom. III. p. 281.
4. . . in *Tranſactions*, Nº 355.
5. . . . . . . . . . 373.
6. . . . . . . . . . 358, 359.
7. . . . . . . . . . 362.
8. . . . . . . . . . 361.
9. . . at the End of the 8 preceding, under the Title of *Diſſertationes Phyſico-Mathematicæ*, *Auctore* Jacobo Jurin, *M. D.* Lond. 1732. 8º. See Page 607.



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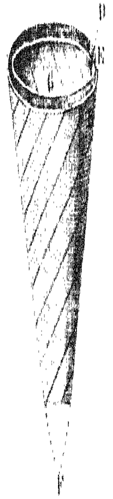

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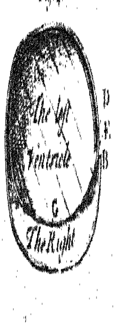

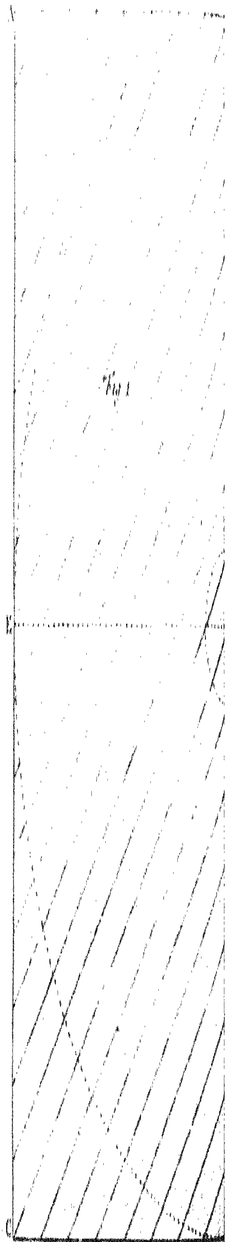

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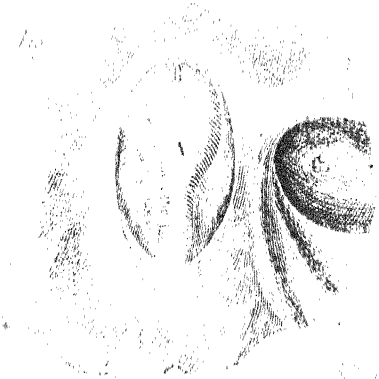

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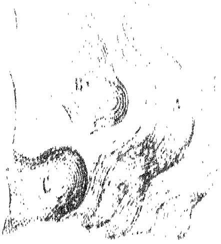

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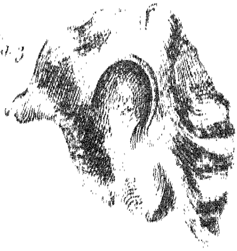

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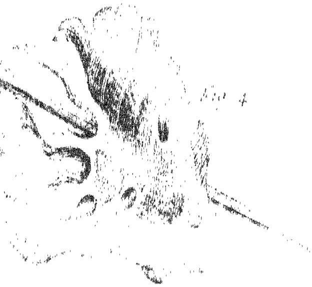

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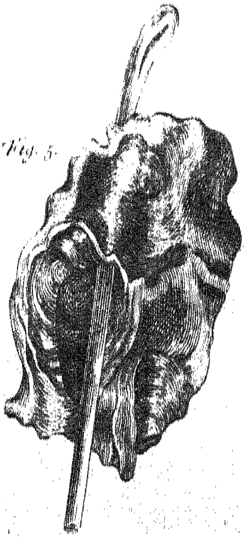

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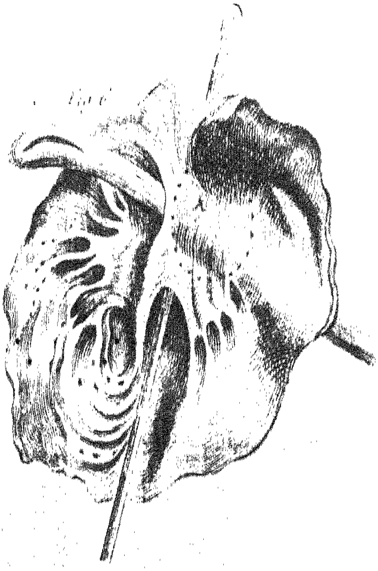

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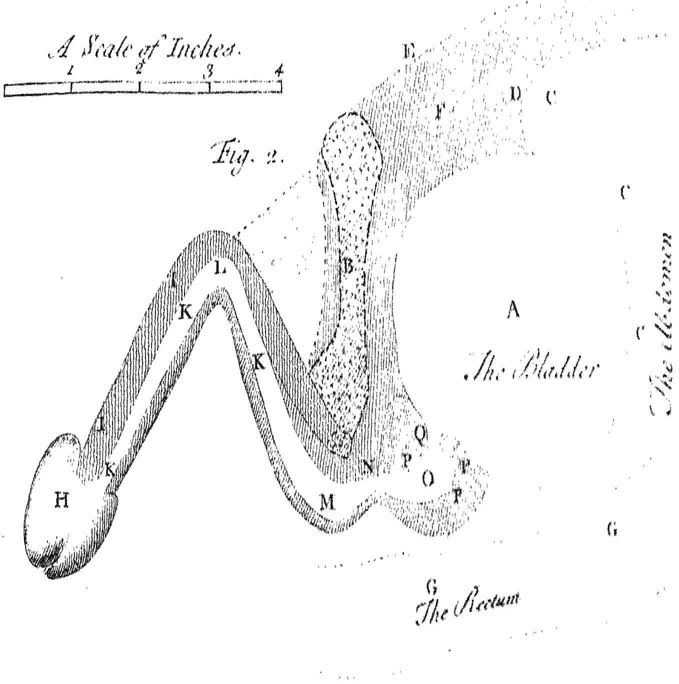

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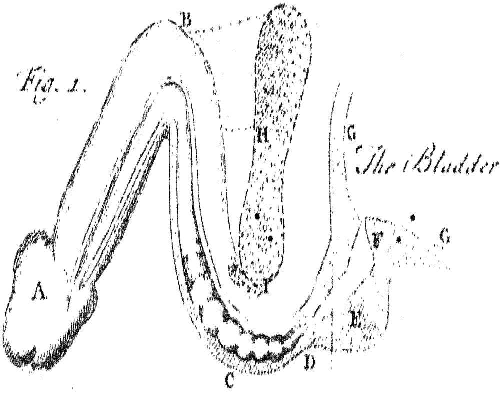

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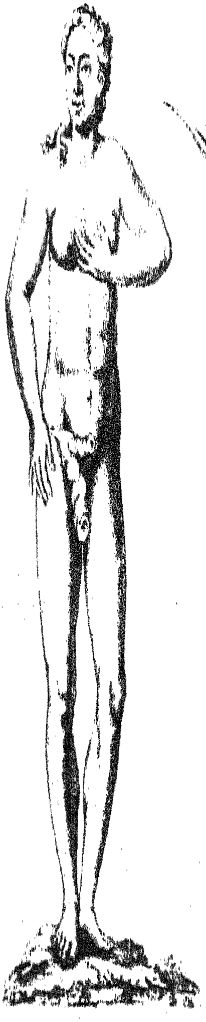

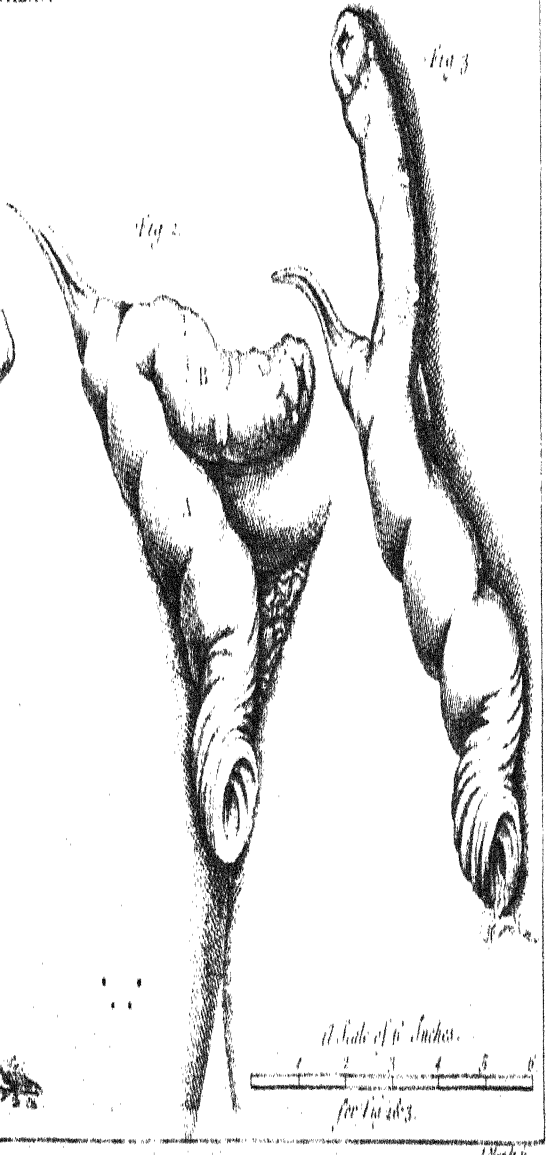

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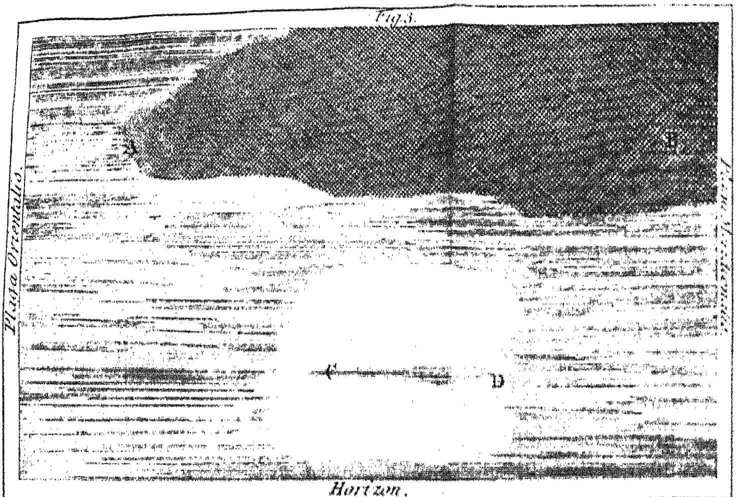

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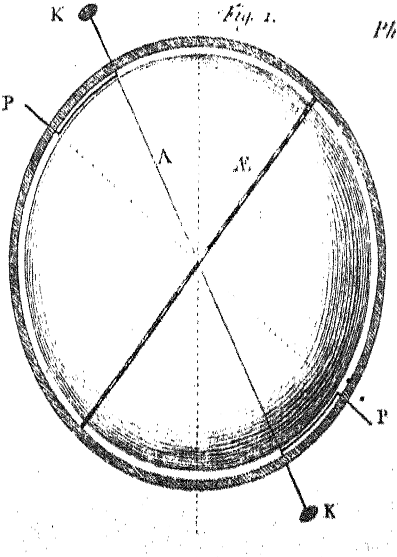

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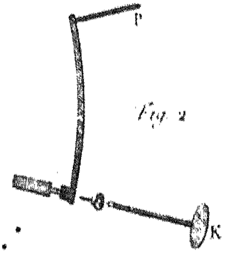

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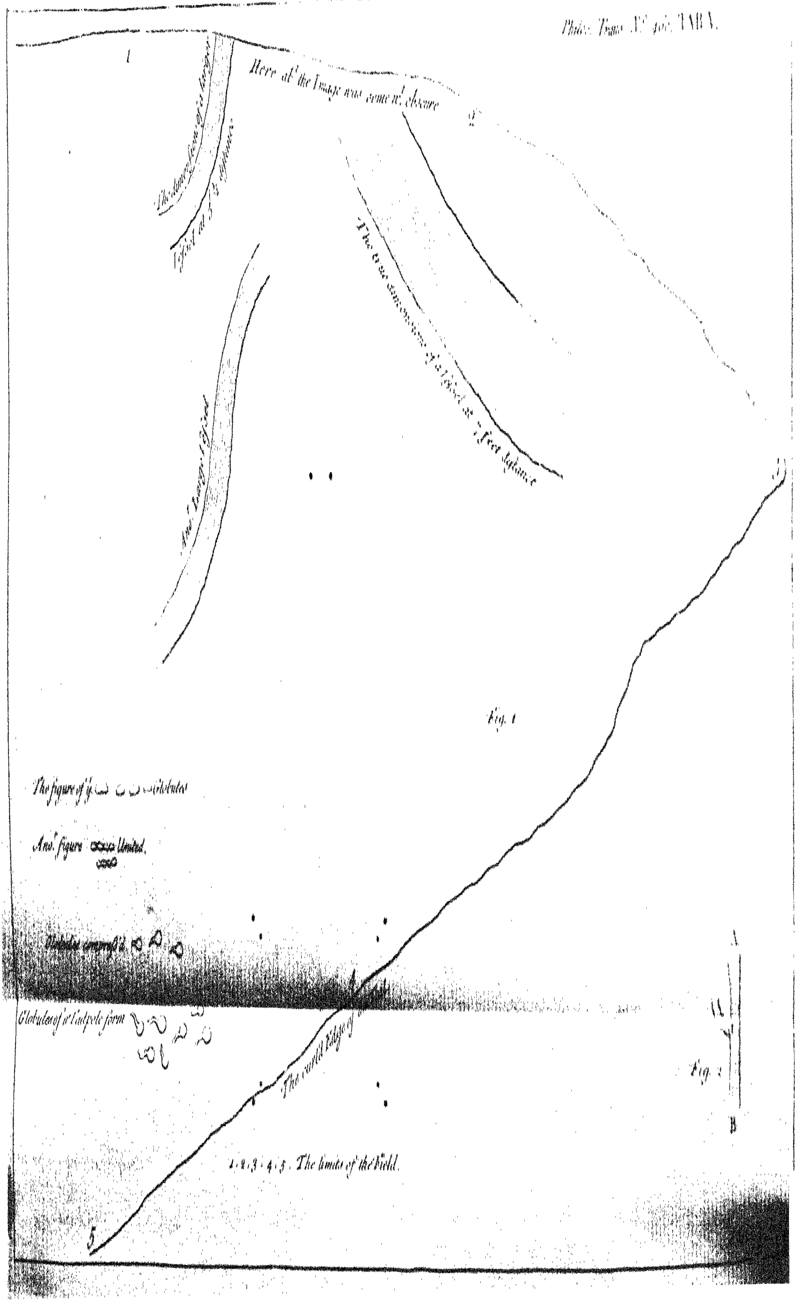
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5
1, 2, 3, 4, 5. The limits of the field.
A
Fig. 2
B

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# PHILOSOPHICAL TRANSACTIONS.

For the Months of *April*, *May*, *June* and *July*, 1741.

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VIII. *A Letter from Mr.* John Powell, *to Sir* Hans Sloane, *Bart. Pr.* R. S. *&c. concerning a Gentlewoman who voided with her Urine,* hairy cruſtaceous Subſtances: *To which is annexed Sir* Hans Sloane's *Anſwer, containing ſeveral Obſervations of* extraordinary Subſtances *voided by the* Urinary Paſſages. 699.

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# I. *Several* Electrical Experiments, *made at various Times, before the* ROYAL SOCIETY, *by the Rev.* J. T. Deſaguliers, *LL. D.* F. R. S.

## 1. *An Account of ſome* Experiments *made before the* ROYAL SOCIETY, May *the* 14th, 1741.

I Mentioned in one of my former Papers concerning Electricity, that Electrics *per ſe* would not receive the Electricity of a rubbed Tube, ſo as to carry on to a Diſtance; but that, if thoſe Bodies were changed into Non-electrics, they would then receive and convey the Electricity of the rubbed Tube, in the ſame manner as all other Conductors of Electricity do. The Experiments which I made to prove this plainly, are as follow:

### EXPERIMENT I.

I ſuſpended a long ſmall glaſs Tube at about the Diſtance of 14 or 15 Inches from an horizontal extended Cat-gut in the ſame Poſition, or parallel to it, by Two ſmall ſilken Threads; and, with a ſmall Packthread, hung an ivory Ball on the End of the ſuſpended Tube; and, applying the rubbed Tube to the other End, (though lightly excited, as appeared by its ſnapping) no Electricity was communicated to the Ball: Though, when a very ſmall Packthread was hung from one End of the Tube to the other, the ivory Ball became very electric, as appeared by its attracting a Thread hung on a Stick. Then taking off the Packthread, and wetting the Tube from one End to the other, with a Spunge, it became a Non-electric,

tric, and conveyed the Electricity to the Ball as ſtrongly as the Packthread had done.

### EXPERIMENT II.

The Tube being well dried, I applied a Silk in the ſame manner as I had done the Packthread; but no Electricity could be conveyed to the Ball by applying the rubbed Tube to the contrary End of the Silk. But afterwards, having wetted the Silk, it became a Non-electric, and received the Electricity, which it communicated to the Ball.

*N. B.* I choſe a glaſs Tube for this Experiment, becauſe Mr. *Du Fay* had made uſe of glaſs Tubes for the Supporters of his Conductors of Electricity; and Silk, becauſe Mr. *Gray* had ſupported his Conductors of Electricity upon Silk.

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## 2. *An Account of ſome* Experiments *made before the* ROYAL SOCIETY, *on* Thurſday, May *the* 28*th*, 1741.

THAT it is not the Quantity of Matter in Bodies, that makes them more or leſs receptive of Electricity, and conductive of it, but intirely their Quality, appears by the following Experiments.

### EXPERIMENT I. Fig. 1.

From a Cat-gut String *A B*, about 12 Foot long, ſtretched horizontally Six Foot above the Floor of the Room, I ſuſpended Two Iron Bars *C D*, *E F*, of about 40 Inches long, and a Quarter of an Inch ſquare, by the ſilken Strings *Cc*, *D d*, *E e*, *F f*, which at firſt touched at their Ends *D*, *E*; and from the End *F* of the Bar *E F*, there hung, by a Packthread, the ivory Ball *G*. Then having rubbed a large Tube *I K* to excite its Electricity, I applied it near the End *C* of the Firſt Bar; and the electrical Virtue ran along the Two Bars, and impregnated the Ball *G*, as appeared by its attracting the Thread hanging from the Stick *H*, at about Three Inches Diſtance. Afterwards I ſeparated the Tubes, in the manner that they appear in the Figure; and the Electricity was communicated to the Ball but faintly when the Bars were an Inch and an half aſunder, and not at all when they were Two Inches and an half aſunder. But this was owing to the moiſt State of the Air; for, when the Air is very dry, the Virtue will jump Six or Nine Inches; but when the moiſt Particles, that float in the Air, are attracted by the Bars, the Virtue will reach but a little Way; though, if that Moiſture be fixed upon any Body, which (being an Electric *per ſe*) would not conduct the Electricity applied to its End, the Virtue will be carried from one Bar to another as well as if they had touched, as will farther appear by the next Experiment.

### EXPERIMENT II. Fig. 2.

Having ſeparated the hanging Bars ſo far aſunder, that the Electricity could not jump from the one to to the other, (*viz.* about Three Foot) I laid upon their End the ſmall Tube *DE*, having wiped it very dry: Then, applying the rubbed Tube to *C*, the Virtue ſtopped at *D*; and neither the Bar *EF*, nor the Ball *G*, received any Electricity, the Thread *H* being attracted by neither of them. But, having blown through the Tube, the Moiſture of the Breath changes it from an Electric to a Non-electric; and then the Virtue of the rubbed Tube runs along freely from *C* quite to the Ball at *G*, which then ſtrongly attracts the ſuſpended Thread.

*N. B.* When the Air is very moiſt, the Tube *D E* is turned to a Non-electric without blowing, only by the watery Particles adhering to it.

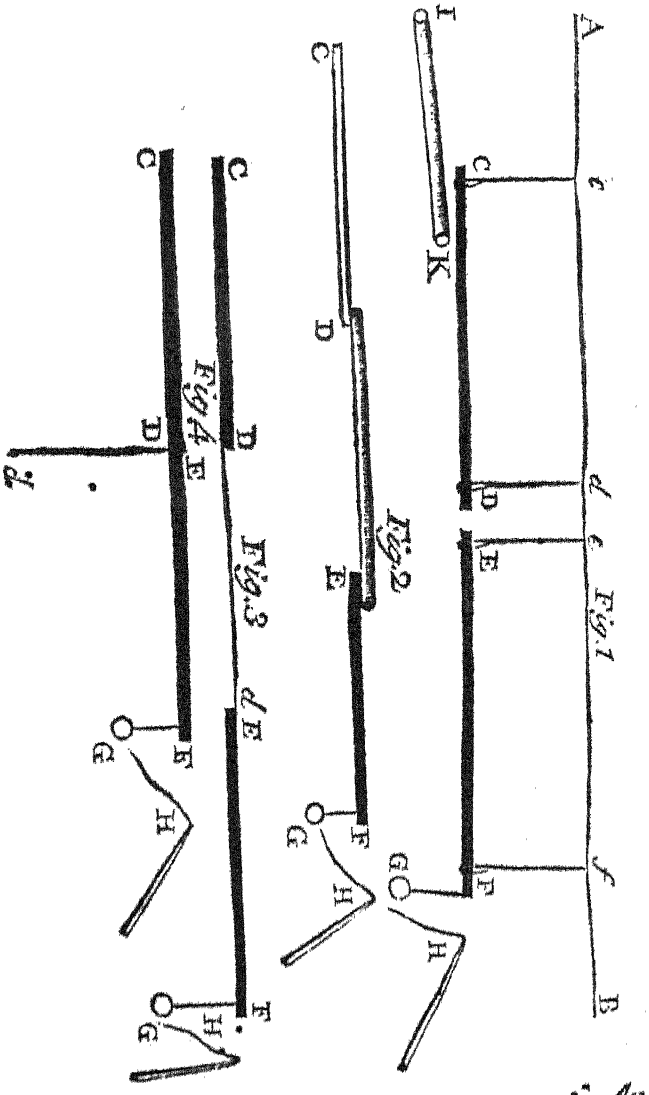
### EXPERIMENT III. Fig. 3.

The Bars remaining in their Situation, I took off the Tube, and ſtretched a very fine white flaxen Thread from *D* to *E*, which touched both the Bars: Then applying the rubbed Tube to *C*, the Virtue was carried from Bar to Bar, and the Ball *G* attracted the Thread *H* at Two Inches Diſtance. Afterwards wetting the Thread, the Attraction became much ſtronger at *G*, ſo as to attract the Thread *H* at Four or Five Inches Diſtance.

### EXPERIMENT IV. Fig. 4.

Having joined together the Ends of the ſuſpended Bars, I ſuffered the Thread *D d* to hang down, but touching no other Body; then the Electricity was freely communicated (by applying the rubbed Tube to *C*) from *C* to the Ball at *G*. But if *d*, the lower End of the Thread, touched the Ground, or a Chair, or was taken hold of by any body's Hand, or lifted up by a walking Cane; then the Electricity advanced no farther on the Bars than *D*, but was interrupted by the Thread *D d*, and carried to the Bodies contiguous to *d*, when they are Non-electric. If the End *d* of the Thread was laid upon a dry glaſs Tube, held in the Hand of an Aſſiſtant, then the Electricity ran as before, along the Bars to the Ball *G*. The ſame thing alſo happened when the End *d* of the Thread was thrown up upon the Cat-gut String; for in that

Caſe the Electricity, having impregnated the String, did afterwards run along the Bars, *&c.*



## 3. *An Account of ſome new* Electrical Experiments, *performed before the* ROYAL SOCIETY, Thurſday, Aug. 29. 1741.

HAving found by ſeveral of Mr. *Gray*'s Experiments, as well as ſome of my own, that Water is receptive of Electricity, ſo as to be raiſed up in a little Cup, to emit a Vapour towards the rubbed Tube, to ſnap, and to give Light; having alſo found, (as I ſhewed the Experiment before the ROYAL SOCIETY) that when a dry Tube, ſuſpended horizontally, will not conduct the Electricity of the rubbed Tube applied to one of its Ends; and yet, when blown into, will conduct it ſtrongly all its Length, becauſe the Electricity runs along from one moiſt Particle to another, though thoſe Particles are not contiguous—— I thought that Electricity might impregnate a whole Jet of Water, whether perpendicular, oblique, or horizontal: And ſuppoſed alſo, that if at any time there be electrical *Effluvia* in or above a Cloud, that Virtue may be communicated by the falling Rain, to any thing that the Rain falls upon. How far my Conjecture is true, will appear by the following Experiment.

Having properly ſuſpended (that is, ſuſpended by ſome electric Body, here Cat-gut) a copper Fountain with the Spout downwards, I opened the Cock, and let the Water ſpout into a Veſſel underneath: Then, having excited a great Tube to Electricity, I held it over the copper Fountain, whilſt an Aſſiſtant held the Thread of Trial (that is, a Thread hanging from a Stick) near ſeveral Parts of the Jet, which attracted it ſenſibly: Then I applied the rubbed Tube near to the falling Jet, which attracted it ſtrongly, ſo as to bend it into a Curve, and ſometimes cauſe it to fall out of the Veſſel below.

## II. *A Letter from* John Huxham, *M. D.* F. R. S. *to* Thomas Stack, *M. D.* F. R. S. *concerning an Extraordinary* Venereal Caſe.

*Dear SIR,*

I Have now ſent you the uncommon Venereal Caſe I promiſed in my laſt, which, I think, hath ſomething very remarkable in it, and ſeems very much to confirm the Great *Boerhaave*'s Opinion, that the Seat of the *Lues Venerea* is in the *Membrana adipoſa*.

Mr. *R. B.* aged about 27, of a bilious, dry Conſtitution, had, for ſome Years before his Death, contracted a virulent *Gonorrhœa*, which was ſcarce well cured before he got a Second, and at length a Third.—— To complete his Miſery, being in the Fleet at *Portobello*, he had frequent impure Converſation with ſome of the *Negro* Huſſies (who probably laboured under the worſt Species of *Pox*, called the *Yaws).*

He returned with a very troubleſome Itching all over him, though no Puſtules appeared; was much thinner than uſual, and had a horrible ſtinking Breath, and ſpit frequently a foul, corrupt Matter.——As he had no Running, Ulcer, *Bubo*, or *Nodes*, he thought all ſafe.——But not many Days after his Arrival at *Portſmouth, poſt impurum cum impurâ Coitum*, a violent Green-coloured *Gonorrhœa* appears.——For this he put himſelf under the Care of a Surgeon, who, after much Pain to no Purpoſe, endeavoured to ſalivate him, but that alſo in vain.——The *Gonorrhœa* indeed was much abated, but a *Bubo* was riſen in his Left Groin, and ſome ſmall verrucoſe Eruptions about the *Anus*.

In this Condition he returned here, and put himſelf under the Hands of Mr. *St*——, an ingenious Surgeon, who endeavoured to bring the *Bubo* to Suppuration, but without Effect; for it ſoon receded, and forthwith violent Pains ſeized him in and about the Fundament, which ſoon produced an exceeding painful *Phyma* near the Verge of the *Anus* on the Left Side.

I was conſulted now, and adviſed to bring it to Suppuration as ſoon as poſſible, which was done in Two Days; from whence iſſued abundance of purulent bloody Matter.——In a Day or two more, another appeared on the other Side, which ſoon vented the like Matter.——The *Verrucæ* alſo now grew more numerous and larger, and many puſtular and ſcaly Eruptions appeared all over him.

I ordered him to be fumigated with *Cinnabar*, and adviſed him to enter on a Salivation forthwith.——But, antecedent to it, as his Humours were exceedingly tough and acrid, I put him on a Courſe of very plentiful Dilution; and this the rather, as he was naturally of a dry and hot Conſtitution, and beſides had lately been roaſted in the *Torrid Zone*.

I began, as uſual, by giving him *Calomel*; which, though it neither purged or vomited him, yet, after having taken Five Drachms, produced no Degree of Salivation, nor did it make his Gums ſore.——However, it brought on his *Gonorrhœa* again: I then ordered him once and again, Eight or Ten Grains of *Turbith mineral*, which ſcarce puked him, and gave him only Two or Three Stools. — I now found, indeed, that *Mercury* and he, as well as *Venus*, had been old Acquaintance; ſo I greatly augmented the Doſe of the *Mercurials*, ordering immenſe Quantities of thin watery Diluents: Notwithſtanding this, there was very little Operation by Stool, and ſcarce any by Salivation. Though his Gums and *Fauces* were very ſore and ſwoln, he ſcarce ſpit One Pint in 24 Hours, and that exceſſively tough and fetid.—— Even under this ſtrong *Mercurial* Courſe, the puſtular and leprous Eruptions increaſed daily, ſo as to cover almoſt his whole Body, nay his very Face. His Hands and Feet were vaſtly ſwoln, as in an *Elephantiaſis*, with horrid Fiſſures, from whence iſſued a very ſtinking ichoroſe Matter.

I was quite confounded at this dreadful Face of Things, and ſeriouſly bethought me what further Method could be taken againſt ſo terrible an Enemy. ——I had recourſe to a warm emollient Bath, in which his whole Body was immerged; after which he was well anointed with a ſtrong *Mercurial* Ointment.—— This was done for Three Days ſucceſſively: Notwithſtanding which, though his Chaps grew exceeding ſore, and his Throat ſo much inflamed and pained, that he ſwallowed with extreme Difficulty what he ſucked through a Pipe or Quill, yet the Spitting was very little increaſed, and as tough as ever: Nor did the fiſtulous Ulcers ſeem in the leaſt diſpoſed to heal up, but vented a vaſt Deal of ſtinking, oily, ſanious Matter; nay, even new ones broke out under each *Axilla*, and a very large *Phyma* roſe on the *Coccyx*,

which

which ſoon diſcharged the ſame kind of virulent Matter; though we found the Bone, and even the *Perioſteum*, quite ſound and untouched.

The Scales were now grown ſo hard and ſtiff, that he could ſcarce bend a Limb, or Finger: Moreover, Abundance of Ulcers, from whence flowed great Quantities of greaſy, purulent, and ſomewhat bloody Matter, were broke out in his Thighs and Buttocks. ——A very large Tumour was alſo riſen in his Right Breaſt, and ſoon after on the Left, voiding prodigious Quantities of the ſame kind of Matter.

It was obſervable, that where-ever any of theſe Ulcers appeared, they ran only under the Skin, being intirely ſeated in, and feeding on, the *Membrana adipoſa*; ſo that the Muſcles and Tendons underneath appeared as fair and florid as in the moſt healthy Conſtitution.

I now unfortunately found, though too late, there was nothing to be done by *Mercury* in any Form; and therefore determined to run it off, and try the *Guaiacum* Method and Sweating, ſo much recommended of old (and in ſome Caſes ſo juſtly) by Sir *Ulric Hutton*, and others; at the ſame time keeping up a moſt plentiful Dilution, attempting withal to detach the ſcaly *Cuticle* by continued emollient Baths, which at the ſame time alſo would partly act by Dilution.——By this means the Scales came off apace, juſt in the manner uſual in the confluent *Small-pox*; only the *Exuviæ* were here much larger, ſeveral being above Four or Five Inches over.——In about a Week's time, this Coat of Mail was pretty well cleared off, and his Breath, from the moſt horribly nauſeous I ever ſmelt, became as ſweet as that of an

Infant. Nor was the Matter ſpit, though ſtill very viſcid, any way fœtid: For the *Mercury* was pretty well run down by lenient Cathartics, and the Sloughs of his Mouth caſt off.

He was now become exceedingly emaciated: Wherefore I ordered him plentiful liquid Nouriſhment with Vipers, and large Dilution, avoiding every thing that was in the leaſt groſs or fatty.——But with all this he ſtill kept to his Three Pints of ſtrong Decoction of *Guaiacum* every 24 Hours, ſweating at leaſt Two or Three of them.

Under this Method I conceived ſome Hopes of his Recovery, as he ſeemed now to gain ſome ſmall Degree of Strength and Spirit; but ſtill his Ulcers rather increaſed than abated, and continually diſcharged a vaſt Quantity of Matter, though by no means ſo thick, putrid, or bloody;——and, indeed, in a moſt profuſe Manner from under each *Axilla*.

But, what is vaſtly ſurpriſing, notwithſtanding all the paſt Method and Medicines, Two very large Chancres now appeared on the *Glans Penis*, and a very conſiderable *Bubo* in the Left Groin.——A troubleſome Cough ſoon alſo ſeized him, with Shortneſs of Breath; and he began to expectorate a purulent, and ſometimes bloody kind of Matter.——As the whole *Membrana adipoſa* without, had been conſumed by the Diſeaſe, it was now falling on that Part of it that inveſted the more vital Parts.——But Nature could ſupport no longer.——He died in the extremeſt Degree of a pocky Conſumption.——But not one ſingle Bone of any Part of his Body appeared to be touched, though he died with near 40 Ulcers upon him.

*Dear SIR,*

Plymouth,
Oct. 16. 1739.

*Your humble Servant,*

John Huxham.

In another Letter dated at *Plymouth, Nov.* 30. 1739. Dr. *Huxham* ſays, "We have had a very "tempeſtuous Seaſon for ſeveral Days paſt, though "now fair; the *Mercury* lower [28.1 Inches] than "I have known it for ſome Years, and the Tides "exceſſively high."

## III. *An Account of* Coal-balls *made at* Liege, *by* William Hanbury, *Eſq*; F. R. S.

IN purſuance of the Orders of the SOCIETY, I ſhall endeavour to give an Account of the factitious Coal made at *Liege*. But firſt I ſhall quote Two Authors, who mention it in their Accounts of the Town of *Liege*.

The Firſt is, *Le Curieux Antiquaire, ou Recueil geographique & hiſtorique, par le S^r* P. I. Berkenmeyer *à* Leide 1729. *p.* 182. Where he ſays, "This "Biſhoprick (*Liege*) has rich Mines *of Houille or* "*Stone-coal* *, which the Inhabitants ſell in the *Ne-*

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* The common People call their Pit-coal, *del Hoy* or *de la Houille*; and the Mixture of Coal and Clay *de Houty*. C. M.

“ *therlands*, and by the Sale of it they get above
“ 100,000 Ducats *per Annum.*”

“ This Coal lights eaſily, and gives a great Heat:
“ It is not therefore to be wondered, that Fire is
“ reckoned amongſt other Advantages the *Liegois*
“ boaſt of: They ſay, they have the beſt Bread, the
“ hardeſt Iron, and the hotteſt Fire: By this laſt they
“ mean, *de la houille*, which, being once well
“ lighted, caſts the greater Heat, if it be wetted with
“ Water.”

The Second Book I ſhall mention is, *Les Delices des Pais Bas*, Vol. III. *p.* 243. where I find that this Town *Liege* is ſaid to be “ the Hell of Women,
“ becauſe they are obliged to work more here than
“ in any other Country. They draw the Boats, and
“ carry on their Backs, like Slaves, *les hoilles*, and
“ other Things; and theſe Women are called *des*
“ *Botreſſes.*”

In the Year 1628. by a printed Paper produced before you, it appears, that this Fuel was known in *England* at that Time; and if you will believe the Author of that Paper, it was diſcovered by *Hugh Plat* in 1594.

There is an Account of it printed in the Eſſays for the Month of *December* 1716. where it is propoſed to be made with the black Ouſe of the *Thames*, and for Four Pence per Buſhel.

I have uſed this Coal and Clay mixed upwards of Ten Years, and by Experience I find it to anſwer very well. It is a moſt excellent Fire for Roaſting, for heating of Irons, or warming a Room: I uſe it in my Kitchen, Laundry, Parlour, and Library.

The Method in which it is made at *Liege*, where I firſt ſaw it, and made ſome myſelf, is as follows:

Take ⅓ of unctuous Clay, (ſuch as Brewers uſe to bong their Veſſels, in it there muſt be neither Sand, Gravel, or Stone)

And ⅔ of Coal-duſt: Mix, and make them incorporate well together; caſt them into round Balls, or Bricks; and you may put them on a Coal-fire, and they will burn directly. But if they are made in Summer-time, and laid to dry for Uſe in Winter, they will light ſooner.

Thus you have an hot, clean, laſting Fire, not at all offenſive to the Smell.

The Duſt is there the Refuſe of the Mine, and may be here of the Coal-merchant's Yard, ſo that this Fuel comes exceeding cheap.

Nor is it neceſſary to put ſo much Coal-duſt; for ſome Clay (particularly what I uſe myſelf in the Country) will do, if mixed ⅔ Clay, ⅓ Coal-duſt; and the true Proportion of the Mixture muſt be found by Experience; but it is always better to put in too much than too little Coal-duſt at firſt, becauſe Men are too apt to be diſcouraged in making Experiments.

This Fuel is not only to be had at an eaſier Price, but it is likewiſe more durable.

How far it may be uſeful in Glaſs-houſes, Brew-houſes, Salt-works, *&c.* I muſt leave to the Conſideration of the ſeveral Perſons concerned in them.

I have heard, that at *Liege* they burn both Lime and Brick with it; but, as I never ſaw it done, I cannot affirm it.

# IV. *A Letter from* Cromwell Mortimer, *M. D. Fellow of the* Royal College *of* Phyſicians London, *Secretary to the* ROYAL SOCIETY *of* London, *Member of the* Gentlemens Society *at* Spalding, *&c. to* William Bogdani, *Eſq*; F. R. S. *and Member of the ſaid Society at* Spalding, *&c. containing a ſhort Account of Dr.* Alexander Stuart's *Paper concerning the* Muſcular Structure *of the* HEART: *Which was read at ſeveral Meetings of the* ROYAL SOCIETY *in* May *and* June 1735. *drawn up at the Requeſt of ſeveral Gentlemen of the* Spalding Society. *Now publiſhed with ſome Additions.*

*Dear SIR,*

I Was out of Town when your Letter of the 23d paſt came to my Houſe, whereby you inform me, it would be highly agreeable to our Fraternity at *Spalding*, if I would oblige them with a ſhort Account of Dr. *Stuart's* moſt curious Papers on the Heart, lately laid before the ROYAL SOCIETY: I did not come to Town till ſome Days after, and then I waited for an Opportunity of ſeeing Dr. *Stuart*, and asking his Leave to ſend you an Account of the Papers, as deſired, which I ought not to do without it: Theſe are the Reaſons of my not having wrote ſooner. I deſire you to make my Compliments to the Society, and beg their Acceptance of this rough Sketch of the Doctor's moſt curious Diſcoveries, which I have drawn by Memory, not having any of the Doctor's Papers by me, except ſome Drawings, of which I herewith ſend you Copies, [and are engraved, with ſome Improvements, in the Tables annexed; ſee TAB. I. Fig. 1, 2, 3, 4.]

I ſhall not here undertake to give a Deſcription of all the Parts belonging to the Heart, ſuppoſing them already ſufficiently known from the anatomical Writers; but ſhall only explain the ſurpriſing Simplicity of the *Muſcular Structure* of the HEART, as the ingenious Dr. *Stuart* hath demonſtrated it from various Preparations of boiled Hearts; *viz.* that *the Heart is nothing elſe than a ſingle Muſcle of nearly a ſemicircular Form, whoſe Fibres are all parallel:* For, ſuppoſe a rectangular Parallelogram *ABCD*, (ſee TAB. I. Fig. 1.) conſiſting of Two Squares *ABEF*, and *EFCD*; in each of which draw firſt the Diagonals *EB* and *CF*; then fill the whole Parallelogram, or both Squares, with Lines at equal Diſtances, and parallel to the Diagonals: This done, at the Centre *F*, with the *Radius FB*, draw the Semicircle *BED*. [and do the ſame on the Back-ſide of the Paper; ſo that every Line on the Back-ſide may lie exactly under each correſponding Line on the Fore-ſide, and that each Side may be as exactly alike, as if the Paper were tranſparent, and that the Lines might be ſeen equally plain on either Side:] Cut this Semicircle out of the Parallelogram, and cut out likewiſe a ſmall ſemicircular Piece at the Centre *F*; then roll up this ſemicircular Piece of Paper in a conical manner, ſo that the Back-ſide of *D* [or to *I*, in Fig. 2.] be folded to the Back of *E* [or to *H* in Fig. 2.] and this Fold turned round, till *E* comes to the Back-ſide of *B*. as in Fig. 3. and the Seam formed by the Edges *BF* and *EF* may be paſted together, only the inner Fold on the Right Side muſt be puſhed back from the outer circular one, ſo as to form a Partition, as at *G*. in Fig. 4. and 3. by which means Two Cavities will be formed, that on the Right Side the Partition in this Form ◡, the other, on the Left Side, almoſt circular, thus, ○, as in Fig. 4. the Outſide of the firſt conſiſting but of one ſingle Fold, the Outſide of the latter conſiſting of a double Fold, and the Partition being but of one Fold: Thus the firſt Cavity repreſents the Right Ventricle of the Heart, the other the Left Ventricle, and the Partition *G* the *Septum*, as in Fig. 4. [All theſe Particulars are diſtinctly expreſſed in Fig. 2. which is to be cut off from Fig. 1. 3. and 4. and is to be folded upon the Line *BD*, ſo that the Letters *EE* and *HH* come exactly Back to Back, and that the Line *EF* and *HF* tally preciſely; paſte this Paper thus folded together Back to Back, then cut off the white Paper to the Rim of the Circle, and cut out a Piece at the Centre to *F*, and you will by this means have a ſemicircular Piece of Paper, with all the Lines repreſented on both Sides tallying to each other, as above deſcribed at Fig. 1. But as it was very difficult to print on each Side of the ſame Paper, ſo as to make the Lines tally, I thought it better to have this Figure printed in a whole Circle, that ſo ſuch, as would be at the Pains, might cut it off, paſte it, and fold it, and thus, as it were, form a Model of an Heart. In this Figure likewiſe I ordered the Engraver to diſtinguiſh the ſeveral Surfaces of the muſcular Coats, by Lines and Dots, in ſuch man-

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ner as Colours are repreſented in Heraldry-graving: Thus the Outſide of the Right Ventricle is ſhaded with Lines running from Top to Bottom pretty cloſe, which denote that you ſhould paint that of a dark Red; the Outſide of the Left Ventricle, with Lines in the ſame Direction, but farther aſunder, to denote a lighter Red; the Inſide of the Right Ventricle is ſhaded with Lines from Right to Left, to denote it ſhould be coloured (for Diſtinction-ſake) blue; then, where the double Courſe of Fibres form the outward Side, or Left Side of the Left Ventricle, and which are not to be ſeparated but by Art, there the Paper is left white or blank; but the Inſide of the Cavity of the Left Ventricle is dotted, to repreſent yellow, that it may be coloured ſo: The colouring the Figure in this manner, makes all the Parts much more diſtinct, when rolled up into a Cone.]

This Model, if I may ſo call it, compared with the Heart of Man or Quadruped, will be found to anſwer in the following Manner: The Edge *BF*, in Fig. 1. or *EF*, in Fig. 2. anſwers to the tendinous Seam or *Sulcus*, which runs along the ſuperiour Side of the Heart; and the Direction of the parallel Lines in Fig. 1. and 2. anſwers to the Courſe of the Fibres in each Part of the Heart; the circular Edge of the Paper *BED* anſwering to the tendinous Circle round the Baſe of the Heart, from which, and the Seam *BF*, all the muſcular Fibres take their Original: The exterior Fibres of the Right Ventricle, next the *Apex* or Point of the Heart at *F*, decuſſate * each other, run inwards, and then, riſing up again towards the Baſe, form that Side of the *Septum* which conſtitutes Part of the Inſide of the Right Ventricle; and likewiſe form the *Columnæ carneæ* of the Right Ventricle: The Fibres of the interiour Courſe of the Left Ventricle decuſſate and form in the ſame manner the internal Fibres and *Columnæ carneæ* of the ſame Ventricle: The external Courſe of Fibres of the Left Ventricle are only a Continuation of thoſe of the Right Ventricle, which together embrace the Heart circularly, while the internal Courſe of Fibres of the Left Ventricle run chiefly from the *Apex* towards the Baſe, ſo that on the Left Side of the Ventricle they croſs the external Courſe nearly at Right Angles; but on the Side of that Ventricle which forms the *Septum*, they run from the *Apex* towards the Baſe, in the ſame Direction as on that Side of the *Septum* which is next to the Right Ventricle.

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* This may be imitated by gumming on Threads, in the ſame Directions as the parallel Lines in *Fig.* 1. turning them back croſs the Hole left at *F*.

The ſeveral Courſes of the Fibres may be eaſily traced in a boiled Heart; and if they are not found to anſwer to the Directions of the Lines on the Paper-cone with the ſtricteſt mathematical Exactneſs, when rolled up as at Fig. 3. you muſt conſider, that the Form of the Heart is not exactly conic, though neareſt reducible to that Figure; and moreover that the Baſe is not a Plane as in the Paper-cone, but of a convex round Form; and the tendinous Circle round it is of a ſmaller Diameter than the Middle Part of the Heart.

By this Structure and Circumvolution of the Fibres, the Muſcle which conſtitutes the Heart, doth, by a ſimple Contraction of its Length, by thoſe external Fibres, which encompaſs both Ventricles, contract the Diameter of the Heart, while by the internal

Fibres, that form the *Septum* and Inſide of the Left Ventricle, it ſhortens the Length of the Heart, or draws the *Apex* up nearer to the Baſe: This is done without any Contrariety in the Action of theſe Fibres, or deſtroying the Force of each other; but, on the contrary, they being all parallel to each other, and a Continuation of the ſame Fibres, do aſſiſt each other in their Action.

The Doctor ſuppoſes this Contraction is not cauſed ſo much by the Influx of the nervous Spirits, as by the Influx of the arterial Blood, through the Coronary Arteries into the Subſtance of the Heart; and that the Contraction of the Auricles comes from the ſame Cauſe; which will be alternate with that of the Heart, becauſe the lateral Branches, which ariſe out of the Trunk of the Coronary Artery, that encompaſſes the Baſe of the Heart and both Auricles, are on one Side diſtributed into the Subſtance of the Heart, and on the other Side into the Coat of the Auricles; and will be alternately compreſſed, and alternately free, as the Auricles and Ventricles are alternately full or empty of Blood.

I hope you will excuſe the Imperfections of this ſhort Account; and that our Brethren will accept it as a Mark of my Reſpect, and that it may ſatisfy their Curioſity for the preſent, till the Doctor's Account at large ſhall be publiſhed. I am,

London, Aug. 7.
1735.
*To* W$^{m}$. Bogdani, *Eſq;*
*&c.* [*then*] *at* Spalding.

*SIR,*

*Your moſt obliged,*
*Humble Servant,*

C. Mortimer.

## V. *A Letter from M.* le Cat, *M. D.* F. R. S. *Surgeon to the* Hotel Dieu *at* Rouen, *and Royal Demonſtrator in Anatomy and Surgery, to* C. Mortimer, *M. D. Secr.* R. S. *concerning the* Foramen ovale *being found open in the Hearts of Adults, and of the Figure of the Canal of the* Urethra. *Tranſlated from the* French *by* T. S. *M. D.* F. R. S.

*SIR,*

I Have ſeen in the *Philoſophical Tranſactions* of the Royal Society, N° 439. that you are not diſpleaſed with Obſervations on the *Foramen ovale* in Adults. The *Anatomical Amphitheatre*, which I have eſtabliſhed at *Rouen*, furniſhes me with frequent Opportunities of obſerving. Laſt Winter, I applied particularly to the Circulation of the Blood in the *Fœtus*.——The Advantages that may be drawn from the Parallel, put me upon making the like Experiments on Adults. I have a number of times meaſured the Cavities of the Heart, and Veſſels that depart from it, in both theſe Subjects; and I therein examined the State of the *Foramen ovale*, *Canalis arterioſus*, &c. I now ſend you my Remarks on the *Foramen ovale* open in the Adult, and ſome few others on the Figure of the *Urethra*.

I have the Honour to be, *SIR*,

*Your moſt humble*
*and moſt obedient Servant,*

Claud. Nic. Le Cat.

## 1. *Of the* Foramen ovale *open in the Adult, and of its different Sorts.*

THIS laſt Winter I opened a great Number of dead Bodies of Men grown, and did not find the *Foramen ovale* open in any of them.

The oldeſt of the Male Subjects, in which I found it open, was a Lad of 15 Years of Age.

Of 20 Bodies of Women, which I examined, in Seven I found the *Foramen ovale* open.

Among the Number of Openings that remain of this *Foramen*, there is a great Variety in their Shape, and in that of the *Cicatrices* or Adherences of the *Valve*: However, they may conveniently be reduced to Three Sorts, expreſſed in the Figures hereto annexed, ſee TAB. II.

The Firſt and Second Figure repreſent the Firſt Sort of *Foramen ovale*, that remains open in the Adult.

The Third and Fourth Figures repreſent the Second Sort; and Fig. 5 and 6. the Third.

### EXPLANATION *of the* FIGURES.

FIG. 1. The *Foramen ovale* viewed on the Side of the Right *Auricle*.

A. *A* Valve *that throws itſelf on the Side of the Left* Auricle, *and appears cloſed up chiefly by a Continuation of the* Membrane *that lines this* Auricle.

B. *The Place where this* Valve *leaves a Hole, which opens into the Left* Auricle.

C. *The Part contiguous to the Right* Ventricle.

Fig. 2. The ſame *Foramen ovale* viewed on the Side of the Left *Auricle.*

A. *The* Valve *drawn a little back, that the Hole may be ſeen.*

B. *The Point to which the* Valve *aſcended, when left at Liberty.*

C. *The Part which leads to the Left* Ventricle.

Fig. 3. The Second Sort of *Foramen ovale* open in the Adult, and ſeen on the Side of the Right *Auricle.*

*It differs from the Firſt Sort, in being more ſunk in, or more approaching the Shape of a Funnel.*

Fig. 4. The ſame *Foramen ovale* of the Second Sort, ſeen on the Side of the Left *Auricle.*

*It differs from the ſame Side of that of the Firſt Sort, by the* Valve *beginning to make the* Gooſe-foot *by its different Attaches, which much reſemble the Columns of the mitral* Valves *of the Heart. In the Figure I have added a Probe paſſed into the* Foramen ovale *from the Right* Auricle *to the Left.*

Fig. 5. The *Foramen ovale* of the Third Sort open in the Adult, viewed on the Side of the Right *Auricle.*

*This Sort differs from the preceding Two, by the* Foramen ovale, *nearly forming a Funnel.*

Fig. 6. The ſame *Foramen ovale* viewed on the Side of the Left *Auricle*, and Two Probes paſſed into its Aperture.

*This Sort differs from the preceding ones, by the* Gooſe-foot *formed by the* Valve *being much more compounded.*

*The Circle of Points* A. *marks the Place which anſwers the oval Cavity that is in the Right* Auricle, *and is the* Cicatrix *of the* Foramen ovale *at the Birth.*

*The Women in whom I have found the* Foramen ovale *of the Second and Third Sort, were about 60 Years of Age.*

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## 2. *The* Figure *of the Canal of the* Urethra *determined by ſolid Injections.*

THE Neceſſity I am under of ſounding frequently, and the Difficulties that I have ſometimes met with in this nice Operation, have made me reſolve ſcrupulouſly to examine the Figure of the Canal of the *Urethra*.

I have made thereon a number of Experiments, Two of which I ſhall now deſcribe.

### I.

I melted Reſin with Wax, and injected this Liquid through the *Urethra*. I filled the Bladder but half way with it, in order to preſerve all the Wrinkles of the Canal. When the Injection was cold and ſolid, I cut through the *Oſſa innominata*. I diſſected the Left Side of the Canal and Bladder, and the Section of theſe Parts gave me Fig. the 1ſt, Tab. III. of which this is the Explanation.

### Figure 1.

A. *The* Glans.

B. *An Elbow, which the* Ligamentum ſuſpenſorium *cauſes the* Penis *to make.*

C. *Folds, or Wrinkles, of the Bulb or of the Gulf of the* Urethra. D. *The Entry or Streights of the* Proſtate. E. *The Gulf of the* Proſtate, *or the* Verumontanum. F. *Elbow, or Streights of the Entry into the Bladder.* G. *A Section of a Portion of the Bladder.* H. *A Section of the* Pubis. I. *The Root of the Left* Corpus cavernoſum *cut through.*

## II.

I injected another Subject with very thick Glue. I intirely filled the Bladder therewith through the Canal of the *Urethra*, until it was ſomewhat ſtretched. I let this Injection remain to the next Day, and then found it ſolid and elaſtic. I cut the Parts round it, as I had done in the preceding Subject; and afterwards I made an exact Diviſion of the Injection: I put one half of it on Paper, in order to have its Shape exactly; and thereby I obtained the 2d Figure. To it I have added, in pricked Lines, a pretty exact Section of the adjacent Parts.

### Figure 2.

A. *A Section of the Bladder.* B. *A Section of the* Pubis. C. *The Cavity of the* Abdomen. D. *The* Peritonæum. E. *The Integuments of the* Abdomen. F. *The Space between the* Pubis *and the* Peritonæum, *taken up by the* cellular Membrane. *It is the Place of the Inciſion in the high Operation of* Lithotomy. G. *The* Rectum. H. *The* Glans. I. *The* Corpus cavernoſum. K. *The* Urethra. L. *The Elbow of the* Ligamentum ſuſpenſorium. M. *The Bulb or Gulf of the* Urethra. N. *The Streights and Elbow at the Entry of the*

*Gulf of the* Proſtate. O. *The Gulf of the* Proſtate. P.P.P. *Sort of Elbows, or blind Cavities, found therein.* Q. *The Streights of the Entry into the Bladder.*

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## VI. *A Letter from* George Lynn, *Eſq;* *to* Ja. Jurin, *M. D.* F. R. S. *containing ſome Remarks on the* Weather, *and accompanying Three Synoptical Tables of* Meteorological Obſervations *for* 14 *Years*, viz. *from* 1726 *to* 1739. *both incluſive.*

*SIR*,

HAving, for theſe 14 Years laſt paſt, kept a conſtant Regiſter or Diary of the Altitudes of the Barometer and Thermometer, the Quantity of Rain, Courſe of the Winds, *&c.* according to your Invitation (in the *Philoſophical Tranſactions*;) the Five firſt Years of which have been by you communicated to the ROYAL SOCIETY, and taken notice of in the *Tranſactions*; I now, Sir, ſend you the remaining Nine Years at large, ending *December* 1739. in the ſame Method as formerly. But, believing it would be of good Uſe, both here and abroad, if the Mean Heights of the Barometer, Thermometer, and Quantity of Rain in every Month of the whole 14 Years, with the collateral Means, both of the Months and Years, were brought all into one View together, I have taken the Pains to range them accordingly in a Scheme, or Table, herewith ſent, which does not take up much above the Space of half a Sheet of Paper, and may be within Compaſs for inſerting in the *Tranſactions*, either in a Plate, or otherways, as ſhall be thought proper. The Meaning of the ſeveral Columns in that Scheme is, in a great meaſure, explained by the Titles of them; and by the loweſt Line you will find, that the Mean Height of the Barometer for the whole 14 Years is $\overset{\text{Inches.}}{29.58}$; the Mean Quantity of Rain annually, 23 Inches; and the Mean Altitude of the Thermometer $\left|\begin{matrix}56|48\\ 52\end{matrix}\right|$ that is, at the coldeſt time of the Day 56, at the hotteſt 48, and their Mean 52. In the middle Column, *viz.* that of Rain, the *Commas*, *Semicolons*, and *Colons*, over the Figures, denote, by their manner of placing, from the Left to the Right, what Time in the Month the Rain fell, whether at the Beginning, Middle or latter End; the *Comma* [,] denotes a ſmall Quantity, the *Semicolon* [;] a middling Quantity, and the *Colon* [:] a large Quantity; ſhewing the different Proportion that fell at thoſe Parts of the Months. The Thermometer made uſe of all along, is that of Mr. *Hauksby*, and kept conſtantly in the ſame Place, as mentioned by Mr. *Geo. Hadley* in the *Tranſactions*, N° 447. And the Altitudes of the Thermometer are taken but twice a Day, *viz.* at the coldeſt, which is at Sun-riſe, or ſometimes a little after; and at the hotteſt, *viz.* between Two and Four in the Afternoon: By which Method are gained the proportional Heats for every Month in the Year, and their Difference, as alſo between that of Day and Night, for 13 Years together; not reckoning in the Year 1726. which may be ſeen by the Scheme to be in another Method, and not filled up.

Great Care has been taken, in caſting up and dividing, to get the exact Mediums and Sums; and I was not a little ſurpriſed to find, in caſting up the Column of the Mean Altitudes of the Thermometer collaterally, that as thoſe for *July*, being the hotteſt Month, are $\left|{}^{st}_{3\frac{1}{2}}\right|$ to the Altitudes of *June* and *Auguſt*, on each Side of it, come out exactly equal to one another, and alſo thoſe of *May* and *September*; theſe laſt only differing in their Morning and Evening Heats or Altitudes, which does not alter their Medium of $41\frac{1}{4}$. Many other Obſervations may be made, both from the Scheme and Diaries at large, which, no doubt, will be taken notice of: But, having had ill Health of late, I am not able now to collect them, nor to form a Summary of the Winds, which I deſigned to have added ſome way or other in the ſame Scheme. As for any Judgment about the Weather, *&c.* it will be much better had from thoſe who have the Peruſal and Compariſon of the many Meteorological Accounts ſent to the ROYAL SOCIETY: I ſhall therefore only give a few curſory Notes of my own, as I find them, and ſo conclude this Letter.

When there is an Hazineſs in the Air, ſo that the Sun's Light quails by Degrees, and his Limb is ill defined, it is a pretty certain Sign of Rain, eſpecially if the *Mercury* falls. The like Hazineſs, at Night, is ſtill more a Sign of it.

It is obſervable, that though the *Mercury*, in the Summer Months, does not ſo much vary in its Altitude as at other times of the Year, yet in that Seaſon we have the moſt Rain: It ſhould ſeem therefore, that the different Warmths (and conſequently Rarefaction of Vapours) in the upper and lower Currents of the Air, and thoſe Currents mixing, and ſometimes wholly interchanging, are then the more immediate Cauſes of the Rains, if not alſo of Thunder and Lightning.

Black fleecy Clouds, formed upon a ſudden Flurry of the Wind, are generally ſucceeded by a Shower: And,

The ſhifting of the Wind in a little time almoſt round the Compaſs, in hot Weather, is often ſucceeded by a Thunder-ſhower.

Several times, when the *Mercury* has been a good while high, and ſo continues, there has fallen miſtling Rain; eſpecially about the New and Full Moon, with an Eaſterly Breeze, which the Borderers on the Coaſt of *Lincolnſhire* and *Norfolk* call *Tide-weather*, and may be occaſioned by the Vapours ariſing from the Tides, which then cover a vaſt Waſh of Sands in their Neighbourhood.

Thoſe Vapours ſometimes reach us here in *Northamptonſhire*, but I believe ſeldom further Weſt.

The Nights are for the moſt part calmer than the Days; and the Winds ſeldom ſettled in their Quarter, or at their Strength, till ſome Hours after Sun-riſe, and generally die away again before Sun-ſet.

I ſhall add no more, but that I am,

Southwick,
April 21. 1740.

N. Lat. 52°—31′.

*Yours and the* SOCIETY'*s*
*moſt Obedient,*
*Humble Servant,*

George Lynn.

*Syn-*

## *Synoptical Tables of the* Meteorological Obſervations *made by* George Lynn, *Eſq; at* Southwick, *near* Oundle *in* Northamptonſhire, *for the Years from* 1726 to 1739. *incluſively.*

| | The Barometer's Mean Altitude (above 29 Inches) in 100 Parts of an Inch, In the Years | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1726 | 1727 | 1728 | 1729 | 1730 | 1731 | 1732 |
| *January* | | .36 | .28 | .70 | .79 | .61 | .54 |
| *February* | | .51 | .86 | .66 | .39 | .57 | .65 |
| *March* | | .66 | .48 | .54 | .34 | .92 | .57 |
| *April* | .75 | .72 | .48 | .60 | .66 | .51 | .52 |
| *May* | .74 | .49 | .64 | .57 | .55 | .72 | .50 |
| *June* | .63 | .58 | .68 | .69 | .60 | .66 | .71 |
| *July* | .68 | .65 | .64 | .64 | .61 | .72 | .65 |
| *Auguſt* | .45 | .77 | .64 | .72 | .70 | .65 | .70 |
| *September* | .44 | .50 | .59 | .42 | .34 | .70 | .63 |
| *October* | .77 | .44 | .38 | .52 | .49 | .67 | .68 |
| *Novemb.* | .74 | .84 | .53 | .32 | .55 | .54 | .75 |
| *Decemb.* | .50 | .33 | .51 | .52 | .83 | .61 | .47 |
| **The Mean Altitudes in the ſeveral Years.** | | .57 | .56 | .57$\frac{1}{2}$ | .57 | .66 | .61 |

The

| | The Barometer's Mean Altitude (above 29 Inches) in 100 Parts of an Inch, In the Years | | | | | | | The Mean Altitudes ollate- ally. |
|---|---|---|---|---|---|---|---|---|
| | 1733 | 1734 | 1735 | 1736 | 1737 | 1738 | 1739 | |
| *January* | .68 | .80 | .47 | .26 | .86 | .70 | .45 | .58 |
| *February* | .55 | .60 | .63 | .22 | .58 | .61 | .60 | .55 |
| *March* | .43 | .52 | .36 | .44 | .45 | .46 | .48 | .51 |
| *April* | .65 | .69 | .49 | .70 | .67 | .53 | .34 | .52 |
| *May* | .70 | .54 | .60 | .58 | .70 | .52 | .60 | .60 |
| *June* | .67 | .65 | .56 | .76 | .73 | .50 | .56 | .64 |
| *July* | .67 | .63 | .50 | .67 | .59 | .72 | .67 | .65 |
| *Auguſt* | .56 | .57 | .72 | .63 | .55 | .60 | .61 | .63 |
| *September* | .62 | .56 | .69 | .71 | .46 | .65 | .49 | .56 |
| *October* | .72 | .47 | .69 | .33 | .60 | .52 | .71 | .57 |
| *Novemb.* | .75 | .74 | .45 | .64 | .68 | .67 | .32 | .61 |
| *Decemb.* | .53 | .22 | .59 | .53 | .70 | .58 | .65 | .54 |
| The Mean Altitudes in the ſeveral Years. | .63 | .58 | .56 | .54 | .63 | .59 | .54 | .58 |

The Quantity of Rain in Inches and Decimals for every Month, In the Years

| | 1726 | 1727 | 1728 | 1729 | 1730 | 1731 | 1732 |
|---|---|---|---|---|---|---|---|
| *January* | 4.2 | 3.1 | 4.0 | [illegible] | 0.4 | 0.8 | 1.9 |
| *February* | 1.0 | 2.6 | 0.9 | [illegible] | 1.5 | 1.0 | 1.2 |
| *March* | 1.5 | 1.4 | 3.3 | 1.3 | 2.6 | 0.1½ | 1.4 |
| *April* | 1.0 | 1.2 | 2.0 | 1.1 | 0.8 | 2.1 | 1.2 |
| *May* | 0.4 | 4.3 | 1.4 | 1.6 | 2.5 | 0.3 | 1.4 |
| *June* | 4.0 | 3.2 | 2.8 | 0.8 | 3.4 | 3.4 | 0.6 |
| *July* | 3.7 | 2.0 | 3.2 | 2.3 | 2.0 | 1.7 | 1.8 |
| *Auguſt* | 0.3 | 0.3 | 1.0 | 2.4 | 2.8½ | 1.6 | 1.7 |
| *September* | 5.2 | 2.0 | 0.8½ | 3.3 | 1.6 | 1.5 | 0.7 |
| *October* | 1.5 | 1.5 | 2.8 | 2.2 | 1.0 | 1.4 | 3.7 |
| *Novemb.* | 1.4 | 0.4 | 1.5 | 4.2 | 2.0 | 1.5 | 1.2 |
| *Decemb.* | 2.5 | 2.8 | 2.4 | 1.7 | 0.8 | 2.3 | 2.0 |
| The Mean Quantity of Rain in the ſeveral Years. | 26.½ | 25. | 20. | 23½ | 21. | 17.½ | 20.½ |

The

| | The Quantity of Rain in Inches and Decimals for every Month, In the Years | | | | | | | The Mean Quantity collaterally. |
|---|---|---|---|---|---|---|---|---|
| | 1733 | 1734 | 1735 | 1736 | 1737 | 1738 | 1739 | |
| *January* | 1.0 | 0.5 | 2.1 | 2.3 | 1.0 | 1.7 | 2.4 | 1.8 |
| *February* | 1.4 | 2.6 | 0.7 | 2.9 | 2.2 | 0.8 | 3.1 | 1.6 |
| *March* | 2.2 | 1.8 | 2.2 | 2.1 | 2.1 | 1.0 | 1.3 | 1.7 |
| *April* | 1.0 | 0.6 | 1.7 | 0.6 | 0.4 | 1.3 | 2.2 | 1.2 |
| *May* | 0.02 | 5.1 | 1.5 | 0.8 | 1.7 | 1.9 | 1.9 | 1.9 |
| *June* | 2.0 | 1.3 | 2.4 | 1.4 | 1.8 | 3.4 | 1.5 | 2.3 |
| *July* | 2.2 | 1.8 | 2.3 | 6.0 | 0.7 | 1.2 | 1.7 | 2.3 |
| *August* | 3.6 | 4.0 | 3.2 | 1.7 | 5.7 | 1.6 | 2.5 | 2.2 |
| *September* | 1.4 | 1.7 | 3.2 | 1.4 | 3.8 | 1.8 | 1.8 | 2.3 |
| *October* | 0.6 | 2.8 | 1.7 | 2.6 | 1.8 | 1.8 | 0.8 | 2.0 |
| *Novemb.* | 0.5 | 0.9 | 1.7 | 0.6 | 0.6 | 0.7 | 1.7 | 1.4 |
| *Decemb.* | 1.7 | 4.4 | 2.1 | 2.0 | 2.3 | 1.2 | 1.9 | 2.2 |
| The Mean Quantity of the Rain in the ſeveral Years. | 17½ | 27.½ | 25. | 24. | 24. | 18. | 22.½ | 23. |

The Thermometer's Mean Altitude taken from *April* [illegible] of the coldest and hottest Times of the Day, and their Mean [illegible] in the Years

| | 1726 | 1727 | 1728 | 1729 | 1730 |
|---|---|---|---|---|---|
| *January* | | [illegible] | 60½ | 68 | 60½ |
| *February* | | 58 | 65½ | [illegible]½ | 64½ |
| *March* | | 60 | 56 | 64½ | 58 |
| *April* | 36½ | 48½ | 52 | 55½ | 52 |
| *May* | [illegible] | 42 | 41 | 47½ | 43½ |
| *June* | 33½ | 37 | 35½ | 30½ | 45½ |
| *July* | 34 | 31½ | 30 | 36 | 37 |
| *August* | 35½ | 35 | 38½ | 37 | 38 |
| *September* | | 44½ | 48 | 41½ | 43 |
| *October* | | 54 | 55 | 53½ | 49 |
| *Novemb.* | | 63 | 64 | 59½ | 55½ |
| *December* | | 69½ | 71 | 61½ | 67½ |
| The Mean Altitude [illegible] | — | 50 | 52½ | 52½ | 51½ |

The Thermometer's Mean Altitude taken at the coldeſt and hotteſt time of the Day only, and their Mean, In the Years

| | 1731 | 1732 | 1733 | 1734 | 1735 |
|---|---|---|---|---|---|
| *January* | 75\|69<br>72 | 70\|65<br>67½ | 65\|58<br>61½ | 71\|65<br>68 | 68\|62<br>65 |
| *February* | 70\|63<br>66½ | 61\|53<br>57 | 64\|56<br>60 | 61\|54<br>57½ | 66\|59<br>62½ |
| *March* | 63\|52<br>57½ | 64\|53<br>58½ | 64\|55<br>59½ | 59\|49<br>54 | 64\|56<br>60 |
| *April* | 62\|52<br>57 | 56\|48<br>52 | 57\|46<br>51½ | 56\|44<br>50 | 55\|46<br>50½ |
| *May* | 50\|34<br>42 | 53\|44<br>48½ | 54\|40<br>47 | 53\|42<br>47½ | 53\|43<br>48 |
| *June* | 43\|33<br>38 | 46\|34<br>40 | 43\|29<br>36 | 44\|34<br>39 | 46\|37<br>41½ |
| *July* | 43\|29<br>36 | 42\|31<br>36½ | 38\|27<br>32½ | 40\|31<br>35½ | 42\|33<br>37½ |
| *Auguſt* | 42\|32<br>37 | 47\|33<br>40 | 45\|34<br>39½ | 42\|32<br>37 | 43\|33<br>38 |
| *September* | 48\|36<br>42 | 49\|39<br>44 | 52\|44<br>48 | 51\|43<br>47 | 46\|38<br>42 |
| *October* | 52\|46<br>49 | 55\|47<br>51 | 60\|52<br>56 | 60\|53<br>56½ | 60\|52<br>56 |
| *Novemb.* | 62\|57<br>59½ | 67\|62<br>64½ | 61\|55<br>58 | 66\|62<br>64 | 59\|54<br>56½ |
| *December* | 66\|61<br>63½. | 68\|64<br>66 | 58\|53<br>55½ | 67\|63<br>65 | 64\|60<br>62 |
| The Mean Altitudes of the Thermometer in the ſeveral Years. | 56\|47<br>52 | 57\|48<br>52 | 55\|46<br>50 | 56\|48<br>52 | 56\|48<br>52 |

The Thermometer's Mean Altitude taken at the cold
and hotteſt time of the Day once, and then Mean,
In the Years

| | 1736 | 1737 | 1738 | 1739 | The Me Altitudes of ſeveral |
|---|---|---|---|---|---|
| *January* | [illegible]<br>62 | [illegible]<br>61 | [illegible]<br>60 | [illegible]<br>60 ½ | [illegible]<br>64 ½ |
| *February* | [illegible]<br>60 | [illegible]<br>62 | [illegible]<br>63 ½ | [illegible]<br>56 ½ | [illegible]<br>62 ½ |
| *March* | [illegible]<br>58 ½ | [illegible]<br>61 | [illegible]<br>58 | [illegible]<br>61 | [illegible]<br>59 |
| *April* | [illegible]<br>51 ½ | [illegible]<br>51 ½ | [illegible]<br>53 ½ | [illegible]<br>50 | [illegible]<br>52 ½ |
| *May* | [illegible]<br>40 | [illegible]<br>42 | [illegible]<br>42 | [illegible]<br>43 | [illegible]<br>44 ½ |
| *June* | [illegible]<br>36 | [illegible]<br>41 | [illegible]<br>41 ½ | [illegible]<br>31 ½ | [illegible]<br>36 ½ |
| *July* | [illegible]<br>36 | [illegible]<br>35 | [illegible]<br>36 | [illegible]<br>37 | [illegible]<br>35 ½ |
| *Auguſt* | [illegible]<br>37 | [illegible]<br>43 | [illegible]<br>41 | [illegible]<br>41 | [illegible]<br>38 ½ |
| *September* | [illegible]<br>43 ½ | [illegible]<br>44 ½ | [illegible]<br>47 | [illegible]<br>44 ½ | [illegible]<br>44 ½ |
| *October* | [illegible]<br>50 | [illegible]<br>57 ½ | [illegible]<br>53 ½ | [illegible]<br>56 ½ | [illegible]<br>53 ½ |
| *Novemb.* | [illegible]<br>59 ½ | [illegible]<br>59 | [illegible]<br>60 | [illegible]<br>63 ½ | [illegible]<br>60 ½ |
| *December* | [illegible]<br>61 ½ | [illegible]<br>66 | [illegible]<br>63 ½ | [illegible]<br>68 | [illegible]<br>64 ½ |
| The Mean Altitude of the Thermometer in the ſeveral Years | [illegible]<br>51 | [illegible]<br>52 | [illegible]<br>51 ½ | [illegible]<br>52 | [illegible]<br>52 |

## VII. *Remark of the Caſe of a poor Woman who had a* Fœtus *in her* Abdomen *for Nine Years, opened* May *6th* 1739. *by* William Bromfeild, *Surgeon.*

THIS poor Woman, about Nine Years ſince, was with Child, and, at the Expiration of the uſual Time, was attempted to be delivered.——The Child was ſo far advanced in the Paſſage, that the Midwife declared, that in leſs than Two Minutes the Child would be in the World; but, on the Woman's ſuddenly turning herſelf, the Child ſlipt from the Midwife, and could not be found by her again.

Previous to her being pregnant, ſhe had been afflicted with the Venereal Diſeaſe, and had had a violent Diſcharge of a fetid Matter from the *Uterus*, and was then under the Care of Mr. *Balgay*, Surgeon, who favoured me with being preſent when he opened the Body.——She had been ſalivated once or twice in our Hoſpitals, but to no Purpoſe.——After the Time of attempting to deliver her, to the Hour of her Death, ſhe had prodigious Diſcharges of a fetid Gleet, and frequently indigeſted Matter with Blood from the *Uterus*.——There appeared a Tumour on the Right Side, which was moveable to the other, though its Attachment was chiefly to the Right.——She was troubled with a Suppreſſion of Urine, ever ſince the Attempt of Delivery, and within this Twelvemonth went to Stool in a Cloth inſenſibly, and what *Fæces* deſcended into the *Rectum*, were immediately diſcharged.——She gradually waſted from a hale luſty

Woman, till ſhe was reduced to a mere Skeleton.—— This Account is the beſt I could collect from the good Women who were preſent at the opening of the Body, and moſt of them at the Time of her expected Delivery, and have been very converſant with her ever ſince. ——

Upon opening the Body——

The *Omentum* was intirely waſted: The *Peritonæum* was greatly inflamed, and adhered to the ſubjacent Tumour, which I expected (not being acquainted with the Caſe) to be a Tumour of the ſame kind I had lately ſeen, which was chalky; but, upon cutting into it, there appeared the *Os Frontis*, and, on proceeding farther, the Arm, Leg, and Ribs, on the Left Side,——with ſome viſcid Matter in the Interſtices. ——It was ſeemingly contained in a thick membranous Cyſt——which, upon Diſſection, proved to be the containing *Membranes* of the *Fœtus*, contracted to the Shape of the *Fœtus* in *Utero*, and gave the Tumour an oval Form.——The Situation of the *Fœtus* was in the concave Part of the Right *Ilium*, and by its Cyſt was attached to the *Inteſtines*, *Colon*, and *Cæcum*.——It had ſome Veſſels that ran on the Surface of the Cyſt, that was ſent from the internal *Iliacs* of the contrary Side.——By its Preſſure on the Right *Ureter*, it had hindered the Deſcent of the Urine, and had greatly inlarged both the *Ureter* and *Pelvis*, (of the Right Kidney) which was greatly diſtended with Urine, ſo that what deſcended into the Bladder, muſt ſteal in *guttatim*.

The *Uterus* and *Fallopian Tubes* appeared of their uſual Size, only inflamed.——The *Fimbriæ* were looſe and fluctuating. On examining farther into the

*Pelvis*, there was near Six Ounces of fetid Matter lying between the *Rectum* and *Uterus*, which near its Neck was perforated, and the Parts were very rotten. From its Neck almoſt to the Extremity of the *Vagina*, the Muſcles of the *Anus* were nearly deſtroyed. ——There were ſome few indurated little Tumours adhering looſely to the Cyſt of the *Fœtus*. ——There were ſeveral little Parts appeared like carious Bones found in the Matter contained in the *Pelvis*.——

From what has been ſaid, it appears that the *Fœtus* had been Nine Years in the *Abdomen*.

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## VIII. *A Letter from Mr.* John Powell, *to Sir* Hans Sloane, *Bar*^t.^ *Pr.* R. S. *&c. concerning a Gentlewoman who voided with her Urine, hairy cruſtaceous Subſtances: To which is annexed Sir* Hans Sloane's *Anſwer, containing ſeveral Obſervations of extraordinary Subſtances voided by the Urinary Paſſages.*

*Honoured SIR*, *Pembroke, July* 16. 1733.

HAving the Opportunity of ſending now to *London* by a ſafe Hand, I make bold to ſend you in a Box, ſome things that a worthy Divine's Daughter of this Neighbourhood, whoſe Father has been ſome Years dead, and her Husband now too, has voided ever ſince *Michaelmas* laſt was Two

Years, unleſs it were about Nine or Ten Weeks laſt Summer. She is near 40 Years of Age, and has been married about 17 Years, and had a Child about 12 Years ago, that lived about Nine Weeks.

About *Auguſt* laſt was Two Years, ſhe was ſeized with a Stoppage in her Urine, a ſmall Pain in her Bladder, and a great Pain in the Bottom of her Feet, with the making of whitiſh Water like Whey; and ſhe had then a great Weakneſs in her Limbs, and a Pain in her Bowels; for which another Gentleman, Six Miles off hence, ordered her to go into the cold Bath, by which ſhe found great Benefit for the Pains in her Limbs; but the Pain in her making Water rather increaſed, and then her Urine began to grow fetid; and about *Chriſtmas* was Two Years, ſhe voided the largeſt of the Things you find in the Box, without any very great Pain then, being ſhe had taken a quieting Draught that Night to compoſe her; but, almoſt ever ſince, they put her to moſt exquiſite Pain before ſhe can get them off; and ſhe is commonly forced to take the ſmall Part of the hairy Part between her Fingers, before ſhe can get them off; and oftentimes a good deal of Blood comes off with her plucking them, which makes her very ſore inwardly.

Upon uſing gentle Evacuations laſt Spring was Twelvemonth, ſhe grew much better; ſuch as Vomiting with the *Hypecacuanha*, Purging with *Manna*, Oil of Sweet Almonds, *&c.* and, taking ſometimes Calomel the Nights before, and very often diuretic and balſamic Pills, with and without *Trochiſc. Gordon.* and emollient Decoctions and Emulſions of ſeveral Kinds, the Fetor and Roapineſs in her Urine abated, and ſhe was pretty hearty and brisk, ſo that ſhe undertook laſt *Auguſt* a Journey into *Hereford-ſhire*, and ſtaid there near Two Months, and, I fear, ſhe might take ſome Cold in her Journey; for her Pains grew worſe, and more troubleſome, after her return home; and ſhe then voided great Quantities of thoſe large Subſtances, as well as ſmall, that you ſee; and her Urine grew extraordinary ropy and fetid, notwithſtanding all the Endeavours of another Gentleman and myſelf; and very often the Subſtance ſhe voided would be ſo ſtiff and ropy, that we could ſcarce ſeparate it from the Pot; at other times ſo pliant, that you might take it up a great Height with a Sprig of a Broom, or a Feather, and ſo fall down again like a Lump into the Pot.

She has for this conſiderable time voided one or more of theſe hairy cruſtaceous Subſtances every Day or Night; they looking, when they are firſt voided, like Hair and Coralline; and her Pains are ſo very exquiſite, that we are forced, every Third Night at fartheſt, to give her an Anodyne to quiet her; and that often cannot be done, her Pain being ſo very great.

The Continuance of this ſevere Pain has brought her to a very conſiderable Weakneſs, and almoſt a total Loſs of Fleſh; and, what is her great Misfortune, (eſpecially at this Seaſon of the Year) that Milk will by no means agree with her: She has often tried to conquer it, but never could, it conſtantly making her very ſick in her Stomach, and ſhe vomiting it up in great large Lumps.

We have uſed Injections of Two or Three Sorts, but ſhe cannot well bear them; and ſhe has had her *Menſes* very regularly, till within the Two or Three laſt

Times;

Times; and for theſe 10 or 12 Days paſt, ſhe has complained of a Swelling in her Belly, but none in her Thighs nor Legs.

One thing I had almoſt forgot to have told you, that ſhe has often found a *Crepitus*, or a breaking of Wind, as it were, in her Bladder; which would make one believe, that there is an Aperture from the *Inteſtinum Rectum* to the Bladder.

Her Bladder has been ſearched, and the Surgeon who did it, aſſures her, he can diſcover no Stone; and he is a very ingenious Perſon in his Profeſſion.

She has for theſe Four or Five laſt Days complained, at times, of aſthmatic Fits, which I muſt attribute to the Heat of the Weather.

The Voiding of theſe hairy cruſtaceous Subſtances never occurred to me in my Practice before; though I have above once had Perſons voided large Bladders, like the *Hydatids* in Fiſh, and large Quantities of them, and cured them.

Theſe Subſtances therefore I beg Leave to ſend to you, being, I reckon, there is ſcarce any thing that eſcapes your Obſervation: But whether they have, or have not, I deſire your Opinion of them: and beg you will be pleaſed to inform me what Courſe you judge moſt proper I ſhould take with her.

*SIR*,

*Your moſt obliged, humble,*
*and obedient Servant*,

John Powell.

*P. S.*

She drank the Hot-well-waters both at *Briſtol* and here, but with little Succeſs; has taken *Cantharides* in-

inwardly, as preſcribed by Dr. *Groenvelt*, in Ulcers of the Bladder, and all other things we could think of.

## *Sir* Hans Sloane's *Anſwer to Mr.* Powell.

*SIR*, *London, July* 26. 1733.

I Received yours of the 16th Two Days ſince, together with the Box, and Contents thereof; which I have conſidered, and am ſatisfied, that the hairy Excretions are generated moſt likely in her Kidneys. I have ſeen, in my Practice, ſome Inſtances of the like, and have by me what was brought off by Urine from ſome of them. The firſt I remember, was from a Gentleman near the *Exchange*, who would frequently, Forty Years ſince, void with his Urine long Hairs, which were received on white Paper; and, the Urine paſſing off, would remain there, and, by their Tranſparency and Angles, yielded, on viewing by a Microſcope, the fineſt Colours imaginable, ſuch as we find by a Priſm. This Gentleman did not ſuffer much, though he complained of a Sharpneſs of Urine. The Perſon who was affected the moſt, and applied to me for Help, was a Brewer, who had ſuch Hairs matted or woven together, voided by Urine with great Pain: But then there was no calculous Matter, or very little, added to them. It is very likely, that that Matter is added to thoſe of your Patient in the Bladder, by being retained there. I have a Pin, that a young Woman had ſwallowed, and was afterwards taken out of her Groin from an Apoſtem after a Tumour; which Pin was covered or incruſted, as theſe hairy Subſtances, with ſuch calculous Matter, and got there from the Urine in her Bladder, where in all likelihood it had contracted that Cruſt. I have a ſilver Bodkin, the broad End of which is covered with a pretty large Stone. A poor Gentlewoman thought, by thruſting this Bodkin up the *Meatus urinarius*, to remove a Stone which preſſed upon the Neck of her Bladder, and it ſlipt paſt Recovery into her Bladder; whence, after Three Years, it was taken, and on which, as on a Centre, was bred the Stone. I have other Inſtances of the ſame, where an extraneous Body, paſſed into the Bladder, hath proved as a Centre to attract or have affixed to it ſuch Matter.

As to the Cure, Dilution ſeems to be the beſt. The Brewer was cured by drinking plentifully of ſoft Liquors, which he often poured down; and twice a Week he took the purging Waters. You may gueſs my Opinion to be, that the leſs is generated of this Matter, and the leſs Time it remains in either Kidneys, *Ureters*, or Bladder, the Diſeaſe will be mitigated, and, I hope, cured. I believe *Bath-waters* drank warm, Mallow-tea, Linſeed-tea, Oil of ſweet Almonds, Syrup of Marſhmallows, little and often taken, with Baths of emollient Herbs, may be of great Uſe; and perhaps moderate Exerciſe may help them off. Opiates, in exceſſive Pain, are neceſſary; and now-and-then Bleeding, to take off the Inflammations that muſt of neceſſity attend ſuch a Diſtemper. I alſo think, that ſome Balſamics, ſuch as *Locatelli's Balſam*, may be uſeful; and perhaps, with the emollient Method, take off that Diſpoſition in the Kidneys, which produces this uncommon Diſtemper. The Pains in her Feet, and about her, ſeem not to have any relation to this Diſtemper; and I am of Opinion, that violent Diuretics or Exerciſe will rather hurt than help her. Thus you have my Thoughts on this very extraordinary Caſe; and I ſhall be very glad to hear of the Iſſue of it, and rejoice if I can be uſeful to you in this or any thing elſe, leaving to you the Determination of what you think reaſonable. I beg Pardon for this haſty caſting together ſome things, which, if I had more Time, ſhould be put into better Order by

*Your moſt obedient,*
*and moſt humble Servant,*

Hans Sloane.

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## IX. *A Letter from Mr.* T. Knight *to Sir* Hans Sloane, *Bar*$^{t.}$ *Pr.* R. S. *&c. concerning* Hair *voided by* Urine.

*Hon*$^{ble}$ *SIR,* *Carnarvon, Feb.* 20. 1737.

HAving met with an uncommon Caſe, I thought it proper to communicate the ſame to you, in order to be informed whether the like ever occurred in your long and ſucceſsful Practice, and alſo to beg your Sentiments upon the Matter.

The hairy Subſtance, or fine *Capillamenta*, incloſed in the Pill-box, were diſcharged along with the Urine of a Gentleman during a ſevere Fit of *Ardor Urinæ*; the Gravel that came away was inconſiderable, ſo that the Cauſe of the Dyſury was chiefly owing to the hairy Subſtance with the gritty Matter that adheres to it, inflaming, by their Irritations, the *Ureters* and *Sphincter Veſicæ*, and Parts adjacent. For, notwithſtanding *Phlebotomy*, lenient Clyſters, Emulſions, Opiates, and ſuch-like Remedies, were ſtrictly uſed, all proved ineffectual, till all this extraneous Subſtance was come away.

Theſe fine *Capillamenta* ſeem to be the Tegument of an Animal which had got into the *Primæ Viæ*, and paſſed the *Venæ Lacteæ*, and, by Circulation, paſſed alſo the *Glandulæ Renales*. For it is more probable, (with Submiſſion) that they were extraneous, than that they were generated in the Urinary Paſſages, in an equivocal Manner.

The greateſt Objection, that offers to me, is, that it is judged abſolutely neceſſary, that the *Venæ Lacteæ* ſhould be ſmaller than the fineſt Artery in the Body, that nothing might enter, which might ſtop Circulation of the Blood. Alſo,

That the Mouths of the *Lacteals*, which are open into the Cavity of the *Inteſtines*, (from whence they receive their Chyle) are ſo ſmall as not to be ſeen by the beſt Microſcope in dead Bodies.

To obviate theſe Objections, may not the Mouths of the *Lacteals* be perceptible in living Bodies, when dilated, diſtended, and turgid with Chyle? And may not theſe *Capillamenta*, when relaxed with any Humidity, become very flexible, pliable, and ſuſceptible of being contorted, and of aſſuming any Figure *; and, when thoroughly relaxed, diſſeminated and floating in a Fluid, enter the *Lacteals*; and conſequently may paſs through the Convolution of ſmall Arteries, whereof the Glands and ſecretory Veſſels are formed? for a Gland is ſaid to be nothing elſe but a Convolution of ſmall Arteries.

*N. B.* This Gentleman has kept a ſtrict Regimen of Diet for many Years, as being ſubject to frequent Fits of the Gout, an Incontinency of Urine, *&c.* In the Morning early, a Draught of Cows Milk, *ſtatim ab Ubere*; which oft doth not paſs a *Colatorium*, whereby ſome of the downy Hair about the Udder might get along with the Milk into the *Primæ Viæ*, *&c.* I am, with great Reſpect,

*Your moſt obliged,*
*and moſt obedient,*
*humble Servant,*

T. Knight.

*Remark.*

I doubt of theſe Subſtances being *real Hairs*; I imagine they are rather ſlender grumous Concretions, formed only in the Kidneys by being ſqueezed out of the excretory Ducts into the *Pelvis*. C. *M.*

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* The *Capillamenta*, whilſt in the Urinal, and till the Urine was decanted, appeared only like a groſs turbid Liquor, the Filaments being ſo diffuſed.

## X. *An Account of an extraordinary Caſe communicated by Dr.* Walter Graham, *Phyſician at* Mansfeild, *to Dr.* Mortimer, *Secr.* R. S. *concerning a large Quantity of* Matter *or* Water *contained in* Cyſtis's *or Bags adhering to the* Peritonæum, *and not communicating with the Cavity of the* Abdomen.

IN the Middle of *February* 1735. *Jane Dawſon*, of the Pariſh of *Mansfield* in *Nottinghamſhire*, an unmarried Woman, aged Thirty, received a violent Strain by lifting a Tub of Water, and immediately complained of great Pain in her Left Side.——In *March* following, ſhe found a Lump, or little round Swelling, in that Side of her Belly; and ſoon after the whole *Abdomen* ſwelled, but more in the Left than in the Right Side.——She complained frequently of ſevere Pains in her Bowels, which, in Time, became ſo violent, that ſhe had neither Eaſe or Sleep, but by taking large Quantities of Opium.——During her Illneſs ſhe made very little Urine, and was ſo coſtive, that ſhe had ſeldom any Stools but by the Help of Purges or Clyſters: The former gave her always Pain, and the greateſt Relief ſhe found, was from emollient Clyſters that emptied the *Inteſtines*.——Her Thighs and Legs were not ſwelled, but theſe and other Parts of the Body were much emaciated.——In this unhappy Condition the poor Woman lived about Two Years Nine Months, and died on the 17th of *November* 1738.

I ſhould have mentioned, that, before this Accident of the Strain, ſhe had always enjoyed a tolerable good Share of Health; and ſeldom made any Complaint, but of miſſing her *Menſtrua*.

Upon viewing the naked Body, the *Abdomen* was vaſtly diſtended, and moſt at the Navel: The Swelling was unequal, the Left Side being more ſwelled than the Right; and there appeared a very diſtinct Protuberance all along the Left *Epigaſtrium:* This Protuberance was much ſofter than the other Parts of the Belly, which were ſo hard, that upon Preſſure they did not pit.

Upon opening the Body, we obſerved as follows:

The *Membrana adipoſa* was very thin, and the *Abdominal Muſcles* were much extenuated by the great Diſtention, as is uſual in like Caſes.

The *Peritonæum*, which was the chief Seat of the Diſtemper, and the principal Part to be taken notice of, was grown to ſo monſtrous a Thickneſs, that its Section at the Navel was Five Inches and Two-tenths of an Inch; and it was of the ſame Thickneſs below, but ſomewhat thinner above it.——All over the *Peritonæum*, and throughout the Whole, there appeared a prodigious Number of Glands; and the Space betwixt one Gland and another was filled with a white ſpongy Fleſh.——Some of theſe Glands were round, others oblong: Many of them were as large as a Gooſe's Egg, others about the Bigneſs of a Pigeon's Egg, and ſome leſs; the largeſt were on the Left Side.——Their internal Subſtance was deſtroyed, and only the external *Membranes* left, whoſe Cavities were full of Liquors of different Colours and Conſiſtence: Some contained a thin whitiſh Humour, others a pellucid viſcous

viſcous Gelly, like the White of an Egg, and ſome a white thick Matter, like *Pus*.——As the Contents of theſe *Glands* thus differed, ſo did their *Membranes*; ſome were very thin, others thicker, and many of them were become *cartilaginous*: In general, thoſe whoſe *Membranes* were thin, contained a thin whitiſh Liquor; and thoſe that were *cartilaginous*, a thick white Matter like *Pus*.——Their internal Surface was quite ſmooth, and none of their Cavities had any Communication with each other; nor could the Matter be preſſed out, without opening them with a Knife.

The Protuberance on the Left *Epigaſtrium* was occaſioned by a Quantity of Liquor lodged in a Cavity formed by the *Peritonæum*, which in this Place was about Two-tenths of an Inch thick: This Cavity extended itſelf over the Kidney and Spleen, and there was found in it above Two Quarts of thin Liquor of a darkiſh Colour.——The whole Quantity of Matter taken out of the fore-mentioned Cavity, and thoſe of the *Glands* which were opened, was about Four Gallons.

In the Cavity of the *Abdomen* there was found no Matter, or Water.

The *Omentum* was very white, and much decayed.

The Coats of the Stomach and *Inteſtines* were very thin and tender, and inflamed in ſeveral Places.——The *Inteſtines* lay in the Right Side, and were filled with hard Excrements, forced into that Situation by the large Protuberance on the Left.

The Liver was very large, of a Colour more red than common, and full of Blood, which upon the ſmalleſt Inciſion flowed freely out of it; and the greateſt Part of the Blood in the whole Body ſeemed to be accumulated in this *Viſcus*, and was of a darker red Colour than uſual.

The Gall-bladder was not bigger than natural, nor did it contain any Stones, or concreted Matter; and, upon gentle Preſſure, the Bile moved eaſily through the *Ductus Cyſticus*.

The *Pancreas* was ſmaller than common, and adhered cloſely to the *Duodenum*.

The Kidneys were a little inflamed, and of a flatter Figure than uſual; occaſioned, as I ſuppoſe, by the Preſſure of the *Peritonæum*.

The Cavity of the *Thorax* was greatly leſſened by the *Diaphragma*'s being preſſed upwards, by which the Lungs were likewiſe much compreſſed, and they adhered in ſeveral Places to the *Pleura* and *Mediastinum*.——The Heart was of a paler Colour than common: From the Middle to its *Apex*, it was preſſed flat, and there was little or no Water to be found in the *Pericardium*.

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## XI. *An Obſervation by Mr.* William Watſon, F. R. S. *of* Hydatides *voided* per Vaginam.

A Gentlewoman aged about 48, the Mother of many Children, after a Reſpite of Six Years, had, in *November* 1739. the Symptoms of Conception, which left her in *February*; from which time to the End of *March*, ſhe every Night diſcharged *per Vaginam Uteri* a conſiderable Quantity of Blood; and, not perceiving an Increaſe in her Belly, nor (which in

Caſes of Conception is the *Pathognomonic* Sign of ſomething præternatural) her Breaſts, ſhe concluded her *Menſes* were leaving her at their uſual Period. But, upon the Firſt of *April*, being taken with great Pains in her Back, and having other Symptoms antecedent to Delivery, there came away, at ſhort Intervals, a very large Number of *Hydatides*, of all the intermediate Sizes, from a Nutmeg to a Pin's-head, ſome filled with clear, others with bloody *Lymph*; all of them propagated in the manner of a Cluſter of Grapes from a ſpongious Subſtance, anſwering the Purpoſes of a *Placenta*. After the Diſcharge of theſe, in a few Days ſhe recovered her accuſtomed Health.

Upon boiling ſome of theſe *Hydatides*, they appeared like the *Ovary* of a boiled *Hen*, with this Difference; in the *Hen*, the Contents of the *Ova* concrete; in this Caſe, not; but the Tranſparency was changed to the Colour of Bile diluted with Water.

## XII. *Two* Medico-Chirurgical *Obſervations, by Monſieur* Le Cat: *Communicated in a Letter to Mr. Serjeant* Amyand, *dated at* Rouen, Feb. 10. 1740. *N.S. Tranſlated from the* French *by* T.S. *M.D.* F.R.S.

### 1. *An Obſervation on* Hydatides, *with Conjectures on their Formation.*

*SEptember* 21. 1739. a Woman died in our *Hôtel-Dieu*, who had an *Abſceſs* in the Right *Hypochondrium*, through which ſhe diſcharged *Hydatides*;

with a conſiderable *Tumour* at the Left *Hypochondrium.*

Her Body was opened. The *Abſceſs* of the Right *Hypochondrium* was between the common and proper *Membrane* of the Liver. The *Tumour* on the Left Side was almoſt as thick as one's Head, and twice as long. It was between the common and proper *Membrane* of the Spleen. It ran between the floating Parts of the *Abdomen*, had diſplaced them, and went ſo far as to puſh againſt the Integuments of the Belly, in its Paſſage adhering to the Stomach.

I laid this *Tumour* open, and found it filled with *Hydatides* of all Sizes, with clear Water, and mucilaginous *Membranes*, which were the Remains of large *Hydatides*, that were burſted by the Motions of the Patient. I examined with Care both the *Hydatides*, and their Bag: The *Hydatides* were compoſed of Two mucilaginous tranſparent, and yet very elaſtic *Membranes*. The inward *Membrane* had on its concave Surface a ſort of Villoſity wrinkled and mamillated, that pretty much reſembled the Surface of a rough Skin, or what is called a *Gooſe's Skin*. The ſofteſt and moſt gelatinous of theſe *Membranes* were very like the vitreous Humour of the Eye. The Water contained in all theſe *Hydatides* was intirely like the aqueous Humour of the Eyes.

There were Cluſters of theſe *Hydatides* quite reſembling the *Ovary* of a *Hen*, or a Bunch of *Grapes*, which were made up of Globules of all Sizes.

The Bag that contained theſe *Hydatides* was pretty ſmooth on the Side oppoſite to the Spleen; that is to ſay, that Part of the Bag formed by the common *Membrane* of the Spleen, or by the *Peritonæum*, was pretty ſmooth; but on the Side next the Spleen, the Bottom of the Bag was very thick, and compoſed of ſeveral *Lamellæ* half deſtroyed, which fell off in Bits or Scales, and in Slime, at the leaſt Touch.

*What* Hydatides are.

It appeared plainly upon the Inſpection of theſe Remains of the Bottom of the Bag, that that was the Source of the *Hydatides*: and, upon conſidering what Sort of Parts are found on the Surface of the *Viſcera*, under their Integuments, it ſeems evident to me, that theſe lymphatic Globules were nothing elſe but *the glandulous and lymphatic Grains of the Surface of the Spleen, dilated into Excreſcences by the Diſeaſe, and puffed up by the Lymph, which the Diſtemper cauſed to accumulate therein.*—And thus I conceive this Effect to be produced.

*Proofs.*

I have proved in my *Phyſiology*, which is actually in the Preſs, that theſe glandulous Grains are nothing but the Ends of the Nerves, or nervous *Papillæ*, which receive the Ends of the lymphatic Veſſels into their ſpongy Texture: And I have, among others, inſtanced in the *Papillæ* of the Tongue, called *glandulous Papillæ*, which are at the ſame time the Organ of Taſte *, and the Receptacle of the ſalival *Lymph*.

A Part of the Nerves, which are diſtributed into the Subſtance of the Liver and Spleen, terminate in the Surface of thoſe *Viſcera*, under the Form of glandulous or pulpous Grains. This ſame Surface is the Seat of a great Number of *lymphatic Veſſels*: And it is not to be doubted but thoſe glandulous Grains are as neceſſary for thoſe *Lymphatics*, as the *parotid*

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* See his *Traité des Sens*, Rouen, 1742. 8vo.

*Gland* is neceſſary for the *Lymph* of the *ſalival Duct*, and the *glandulous Papillæ* of the Tongue for the Liquor that diſtils from them. In Quality of *Glands*, they are the Receptacle of thoſe Liquors: As *nervous Papillæ*, they furniſh the Spirits neceſſary for the Functions of thoſe Liquors. All theſe Truths are proved in the Work above-cited. Let us now come to the Conſequences of this Structure.

As long as the *glandulous Papillæ* are ſound, their excretory Pores pour forth the *Lymph* according as their Cavities receive it from the *Lymphatics*: But if theſe Pores happen to be obſtructed by a Diſeaſe; if the Surface of theſe Grains is altered by any Eroſion; or if the natural Tone of theſe Solids is perverted; the *Lymph* brought into theſe Grains will be retained therein: It will ſtretch theſe Globules; their Subſtance, having loſt its Elaſticity, will eaſily give way; the nutritious Juice, which they will not be able to drive farther, will be there aſſimilated, and will contribute to the Dilatation. In fine, a Veſicle will be formed filled with *Lymph*, or an *Hydatide*, ſuch as thoſe we have examined.

This Congeſtion of *Lymph*, or *Hydatides*, will not fail to ſoften, relax, and raiſe up the *Membrane* that covers them; and thus a Bag will be formed like that which we found.

When an *Hydatide* ſwells to a conſiderable Size, the Volume of the Fluid will become diſproportioned to the Force of the Teguments; theſe will be burſt by the Shaking of the contained Fluid, upon the leaſt Motion of the Body. This Fluid will extravaſate into the common Bag, upon opening which the Waters and *Membranes*, which reſult from that Rupture, will be found.

Moſt Part of the glandulous Grains are diſtributed into Cluſters, as is well known to Anatomiſts: wherefore *Hydatides* will alſo be found diſpoſed in Cluſters, like *Ovaries*.

Yet the greateſt Number of this Heap will be compoſed of ſeparate *Hydatides*; becauſe, when one of theſe Globules has acquired a certain Bulk, it will generally break the too feeble Pedicle, which held it attached to the Cluſter; and thus it will fall into the common Cavity.

This kind of Eruption, or general Diſengagement from the Surface of the Bowel, muſt deſtroy its natural Texture, and reduce it exactly to the State in which we found the Bottom of the Bag of *Hydatides*, that were the Subject of this Obſervation.

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## 2. *An Obſervation on the ſingular Conſequences of an incomplete* Hernia, *and on the Functions of the* Inteſtines *expoſed to Sight.*

C*atharine Guilmatre*, of *St. Adrian*, near *Rouen*, aged 50, had a Rupture in the Right Groin, for Seven Years laſt paſt. At *Eaſter* 1739, there happened a Strangulation in her Rupture; and, having no Aſſiſtance, the *Tumour* ſuppurated, and opened of itſelf. The Excrements followed the *Pus*, and the Patient eſcaped at the Expence of Vomitings, and a little Fever.

The *Inteſtine* cicatrized with the *Integuments*, but there remained externally an Opening, through which the Excrements paſſed. The *Anus* ceaſed to perform its uſual Functions; and, that excepted, the Patient was cured.

Towards *Whitſuntide*, there iſſued out at the Wound, beſides the Excrements, a Gut Three or Four Inches in Length; but this Gut was turned Inſide out, that is, the villous Coat was outward, and it conveyed no Excrements; theſe were always diſcharged through the Wound, on one Side, and below the Gut that was come out.

In the Month of *Auguſt* of the ſame Year 1739. there came forth at the Wound another Gut, turned as the Firſt, making with it a continuous Canal, but at its End ſupplying *Fæces*, which had before been diſcharged through the Fiſtula; ſo that, inſtead of the Fiſtula, there was found, as it were, the Trunk of Two *Inteſtines*, which made a kind of Fork, as appears in Fig. 1. 2. and 3. TAB. IV.

The Woman, tired of this Inconveniency, reſolved at length to ſeek Relief. Fortune preſented her with no other than the *Hôtel-Dieu* of *Rouen*. She was brought thither in *December*. I was then in the Country: She was told, that her Diſtemper was incurable; and yet ſhe was kept there till my Return, to ſhew her to me by way of Curioſity.

In Effect, I found her Caſe deſerved my utmoſt Attention; and I had her carried to my Houſe, in order to examine it more at Eaſe, and to have Drawings taken of her Diſtemper, as may be ſeen in Fig. 1. 2. and 3.

What was curious in this Diſtemper, was not an *Anus* formed contrary to Nature in the Groin (that Accident is pretty common); but it was the Two Guts turned Inſide out, their villous Coat, and their

Functions, demonſtrated to the very Eye; as alſo the *Ænigma* occaſioned by theſe Two Guts, which were both of one Piece, as appears in Fig. 1. Tab. IV. and which notwithſtanding had Two Openings, the lower whereof voided the Excrements, and the upper diſcharged nothing. I know of no other Perſon but Mr. *Cheſelden*, who has obſerved an inverted Gut in a living Body: But my Obſervation adds to his, 1*ſt*, Experiments on the Action of Purgatives: 2*dly*, The ſingular Figure of this *Hernia*, the Diſcovery of which has an Influence on the radical Cure of this Diſeaſe, and on thoſe of the ſame kind which may poſſibly happen, as will be ſeen by the Sequel.

I think I may give the Epithet of *Singular* to this ſort of *Hernia*; becauſe, upon Inſpection, one inſtantly conceives, that the Gut which voided the Excrements was continuous to the Stomach, and the other to the *Anus*. But how was it poſſible, that theſe Two inverted Guts ſhould be of one Piece? Let one imagine a Gut cut through by a Strangulation: There remain Two Orifices, one that runs to the Stomach, the other to the *Anus*: If the Canal of each of theſe Orifices turns Inſide out, and prolapſes, as it happens, to the *Anus*; you then have Two Guts prolapſed and turned, but they are diſtinct one from the other, far from being of one Piece. It muſt be allowed, that the *Ænigma* is puzzling: And indeed, a good Number of Surgeons ſaw this Singularity, but not one of them accounted for it. The Reader, if he be an Anatomiſt, has but to attempt the Solution, in order to be ſenſible of the Difficulty. The Figures, Tab. IV. annexed to this *Tranſaction*, perfectly reſemble Life, only ſomewhat contracted.

The villous Coat, and the Functions of theſe *Inteſtines*, being expoſed to the Eye, afforded a Circumſtance ſtill more curious and uſeful. Theſe Two Portions of Guts ſeemed to be Two large living Worms. They move here-and-there, twiſting, ſhortening and lengthening themſelves like Reptiles. The lower Gut was much more alive, and ſounder. One time that I handled it, it twiſted round my Fingers like an *Eel*. The upper Gut, that anſwered the *Anus*, had leſs Motion, and was beſet with Puſtules.

The Expulſion of the *Fæces* engaged our particular Regard: We remarked in its Mechaniſm Two Sorts of Motion.

The Firſt is the vermicular Motion, allowed by moſt Authors. In this, the Gut firſt ſwells, and becomes ſmooth; then grows narrower, running into Wrinkles, and forming Waves the whole Length of the Gut, where theſe Two Motions happen alternately. The Streightening is performed behind, and upon the Excrements, to drive them down; the Dilatation happens before theſe *Fæces*, in order to open them a Paſſage: For Example: When the *Fæces* were at the Orifice, through which we ſaw them iſſue, this Orifice was ſpread open.

The Second Sort of Motion that we obſerved in the Guts, generally preceded the one above deſcribed. In this Motion the Surface of the Gut, being ſwelled and ſmooth, was rendered uneven by many ſmall Impreſſions (or Hollows) diſtributed here-and-there, and which ſeemed to be formed by little local Convulſions, circumſcribed by the *inteſtinal Fibres*. Theſe convulſive Impreſſions reſembled, in little, thoſe that are made in the *Abdomen*, upon contracting ſome one of its *Muſcles*. They made the Surface of the *Inteſtine* a little pale, and thereby formed a ſort of Undulation on its Surface. It was chiefly in this ſort of Motion, that there was ſqueezed out of the villous Coat of the *Inteſtines*, a Mucilage and Seroſity, which flowed from it in Abundance. Both theſe ſeem to ſerve for diluting the *Fæces*, and preparing them an eaſier Paſſage. The cold Air did not fail to excite theſe Motions, and the Woman felt ſome Touches of the Colic.

After having made theſe Obſervations on the natural Functions of the *Inteſtines*, it occurred to my Thoughts to obſerve the Effect of Cathartics therein. One does not often ſee the Inſide of the Guts of a living Perſon in good Health, and freely performing his Functions: Wherefore I was willing to make uſe of ſo uncommon an Occaſion.

Firſt, I put a little Pulp of *Caſſia* on ſeveral Places of theſe Two Portions of Gut. This Medicine made very little Impreſſion on thoſe Parts; they ſtirred very little, eſpecially the upper Gut.

Next, I laid on *Manna*. This, when ſomewhat diſſolved; formed a ſort of Froth, and then the Gut was agitated by vermicular Motions, and by ſmall convulſive Contractions, much more diſtinct than in the Conditions I had examined it before.

I took off the *Manna*, and ſtrewed Powder of *Jalap* on the Gut. At firſt it had no Effect; but, when it was moiſtened, the Gut was violently agitated, diſcharged much Seroſity, and the Patient complained of Gripings. I removed the Powder, and under it I found a great Quantity of Mucilage, that was already gathered there.

I thought it needleſs to harraſs this Woman by further Trials, which would prove much the ſame with the foregoing; and therefore turned my whole Attention on the Means of curing her of this Accident, and thereby rewarding her for the Services ſhe had rendered us.

*The Nature of this Accident explained.*

At firſt Sight of this Diſeaſe, I was as far as the other Surgeons from comprehending the *Ænigma* of the Figure of the Two Ends of the Gut continuous [or of one Piece.] I plainly ſaw, that they were Portions of the *Ileum*; but I was obliged to meditate on it a ſecond time, in order to gueſs at the reſt; and yet nothing ſo eaſy when a Perſon has hit it off.

The *Hernia* which this Woman had at firſt, was one of thoſe named an *incomplete Hernia properly ſo called*; that is, a *Hernia* wherein there was but a Portion of the Side of the Gut pinched within the Ring. This ſtrangulated Portion mortified; the ſound Lips cicatrized with the *Integuments*; the reſt of the Canal remained within the Belly; and the Excrements, which this Remainder of the Canal received, iſſued at its Outlet towards the Groin.

The Patient, being recovered, quitted her Bed, and by little and little occaſioned the turning Inſide out, and Fall of the Portions of the inteſtinal Canal, ſituated above and below the open Part. By this Inverſion, the remaining Coats of the opened Gut came out likewiſe. This Part is ſituated between the Two Portions, one of which anſwers to the Stomach, and the other to the *Anus*; and with theſe Two Portions it makes but one and the ſame Part, or a continued

tinued Plane: Whereſore it was found, out of the Belly, between theſe Two Portions, and formed, as it were, the Trunk of theſe Two Branches.

The Portion, or Branch, correſponding with the *Anus*, muſt have had leſs Motion, and be leſs ſound; becauſe it is deprived of the Share of Life that would come to it from the Continuity of the *Fibres* that were pinched and carried off by the Strangulation, and that it is continually expoſed to the Air. The other Portion is full of Life, becauſe its Continuity with the Stomach makes it enjoy all the Life that this Communication can furniſh it with; and that beſides it remains within the *Abdomen*, while the Patient is in a recumbent Poſture.

In order to give the Pupils of our *Hôtel-Dieu* a clear Notion of the Formation of this ſingular Rupture, I made one juſt like it on a dead Body. For that Purpoſe I made an Inciſion in the *Abdomen*, at the Place of the Rings. I paſſed into it a Gut, in which I made an Opening. I ſewed the Lips of this Opening to thoſe of the Wound of the Belly; and having turned Inſide out the Portions of Gut placed above and below this Opening, they afforded us a Bifurcation of Guts continuous and intirely like that of the Obſervation.

*Method of curing this Accident.*

A Diſeaſe well known is ſometimes half cured. This ſame Portion of Gut that ſupplied the *Fæces*, and that was ſo lively, was drawn back into the Belly, when the Patient lay down, as I have already ſaid; and the other only conſtantly continued out. This Circumſtance made me conceive Hopes of curing this Accident.

Thus I reaſoned with myſelf: It is but firſt making this laſt Gut enter in, and bringing the Diſeaſe to its firſt State: Then, ſeeing there is a pretty large Portion of a Canal ſtill remaining between theſe Two Guts, as appears by the Bigneſs of the Trunk of the Branches formed by them; what remains to be done, after the Whole is reduced, is to cloſe the exterior Orifice of this demoliſhed Canal; that is, to cloſe the Opening made by the Strangulation and Mortification; and I conceive, that this laſt Operation is very feaſable. The next thing to be done is to refreſh the Lips of the Fiſtula formed by the Integuments of the *Abdomen*, which are thick enough, and on which ſhall be afterwards made a *Gaſtroraphia* proportionate to theſe Parts.

The great Difficulty is, to reduce this End of Gut, which is grown hard, and full of Tubercles. I have already made a fruitleſs Attempt, both with Cataplaſms to repair the Damages, and with manual Operations proper for making it re-enter. I am actually watching a favourable Moment for this Operation. If I ſucceed, I intend to ſtay for making a ſecond Operation, till this Gut has remained long enough in the Belly to repair itſelf, and reſume its Functions. In order to that, I ſhall content myſelf for the firſt Eight Days, with keeping it in the Belly, applying reſolving Fomentations, and giving proper Clyſters. Then will I put into the Opening of the inteſtinal Canal, that anſwers to the Fiſtula, a ſilver *Canula* of the ſame Bore with the Gut; in order to puſh this Portion of a Canal into the Belly, to ſupport it therein, and re-eſtabliſh its Communication with the Portion newly reduced. This ſilver *Canula* will be fixed by a Plate of the ſame Metal, guarded with Plaſter and Linen, and placed on the Fiſtula, where it ſhall be ſecured in its Situation by a Bandage. I ſhall then redouble the Uſe of the Clyſters, and when I ſhall be aſcertained of the Re-eſtabliſhment of the Communication of the Two Guts, and the Functions of the Portion continuous to the *Anus*; then I will withdraw my ſilver *Canula*, and will perform the Operation, as I have ſaid above.

## EXPLANATION *of* TAB. IV.

Fig. 1. The Woman with the *Hernia* in *Situ*.

Fig. 2. The *Hernia* repreſented at about half its natural Size.

A. *The lower Part of the* Inteſtine *communicating with the Stomach, and emitting the Excrements.*

B. *The upper Part of the* Inteſtine, *which is continued down to the* Anus, *and emits only* Mucus, *and ſerous Humours.*

Fig. 3. The upper Part of the *Inteſtine* raiſed up, that the Connexion of theſe Two Parts of the *Inteſtines* may the better appear.

XIII. *Some*

# XIII. *Some Remarks concerning the* Circulation *of the* Blood, *as ſeen in the Tail of a* Water-Eſt, *through a* Solar Microſcope, *by the Rev^d Mr.* Henry Miles; *communicated in a Letter to Mr.* John Eames, F. R. S.

*SIR*,

I Well remember the great Satisfaction you expreſſed in the Microſcope made by Dr. *Lieberkuhn*. This induced me to communicate to you an Experiment I have made once and again, with one of the ſame kind, made by Mr. *Cuff* in *Fleetſtreet*.

I had been eagerly wiſhing for an Opportunity to attempt to ſee the Circulation of the Blood in this Way; and for that Purpoſe got ſome *Gudgeons*, which I kept Two Months in Water, this Winter, waiting a favourable Day; but I did not ſucceed well, though I ſaw it plain enough to convince me, that it was worth while to attempt it in a better Subject; for I find the Fins of Fiſh to be of a cartilaginous Nature, have few Veſſels, and thoſe ſmall.—But the *Lacertus Aquaticus* of Mr. *Ray*, commonly called the *Water-Eſt*, having a Tail that ſeems to be much ſofter, and of a fleſhy Subſtance, and abounding with large Blood-veſſels, is excellent for this Purpoſe. Having procured me one of the lighteſt Colour, and moſt tranſparent, I put it into a glaſs Tube, of a Bore juſt big enough to receive it; the ſmaller the Tube, the better, provided you can get it in without injuring it. When I had fixed the Tube in the Body of the Microſcope, I found the exact *Focus*, before I placed the Microſcope on the Tube which receives and conveys the Sun's Rays to the Animal; and, having darkened the Room as much as I poſſibly could, I had a moſt entertaining Sight of it on my Paper Screen, at the Diſtance of Three and Four Feet.——The Magnifier I uſed was the Fourth in *Wilſon's* Pocket Microſcope.——And at the Diſtance of Six or Seven Feet, but not ſo diſtinct.——You have in the Paper which accompanies this (ſee Tab. V. Fig. 1.) the exact Dimenſions of the Field of Viſion (as I call it), taken with a black Lead Pencil, on the Sheet of Paper which was ſtrained in a Frame on purpoſe, at the Diſtance of about Three Feet ¼ from the *Focus*. You have there the true Dimenſions of one of the larger Veſſels, not the largeſt, which, being near the Middle of the Tail, appeared but obſcure. And I have added the Dimenſions of one, the Screen being removed to Six or Seven Feet Diſtance.

In the larger Veſſels, the Motion ſeems to equal that of the Stream of Water which is forced out of a Veſſel by condenſed Air: and makes an Appearance not altogether unlike it, when the Fountain is placed in the Sun: Here you can diſcern no Shape or Form at all of the Globules, but they ſeem all confounded: As the Current proceeds, you have beautiful luminous Reflexions continually. But in the leſſer Veſſels, and in the Parts moſt free from Spots, I ſeveral times ſaw the Globules of an oblong Form, reſembling *Emmets Eggs* in Shape, which I have endeavoured to repreſent in the Paper, gliding along one after another, and often at the Diſtance you ſee them in the Figure, ſometimes joined together; but I have never yet been able to diſcern any Comminution of them. I do not remember ever to have ſeen the Globules to approach this Form, in viewing the Circulation in the common way; but here every thing is magnified to that Degree, that the leaſt Departure from the globular Form appears plainly. Another thing I obſerved, more than once, with Pleaſure; that the Globules would, in ſome Places, gradually ſlacken their Motion, at length ſeem to be about to ſtand ſtill; in an Inſtant, a Globule would be compreſſed, in the Manner I have endeavoured to deſcribe it in the Paper; and then, as if it had ſqueezed through a narrow Paſſage, reſume its former Shape, and paſs on with great Swiftneſs.——

But the moſt remarkable *Phænomenon* of all was, the Shape and odd Motion of ſome of them, near the Extremity of the Edge of the Tail——which exactly reſembled the *Tadpole* in Figure and Motion too, abating that they had not quite ſo much of the wriggling Motion of the Tail of thoſe Creatures in a Pond of Water; but the Head (as I call it, for Diſtinction-ſake) had exactly the ſame Motion. They ſeemed to be roaming about, as if in Queſt of ſomewhat; would turn to the Right and Left, and ſometimes ſeem to be repulſed a little, or to draw back of themſelves, as I have ſeen the *Animalcula* in *Pepper-water* do. I have endeavoured to deſcribe the Figure of them; the Motion has all the Reſemblance that can be of that of the Animals mentioned.——I began to ſuſpect at firſt, they might be *Animalcula*, contained in the Water out of which the *Lacertus* came, which might remain in the Tube, under the Tail: But, on Examination, I found it dry; for indeed the Creature

had

had been out of Water half an Hour, or more, and had been handled (which I ſcruple not to do), and ſo was drained well; ſo that I am certain the Appearance was in the Veſſels of the Creature, though I would not be ſo raſh as to ſuggeſt they were real *Animalcula*: for I preſume the Figure and Motion may be accounted for, without ſuppoſing them to be any other than Globules of Blood, from the State in which the Blood might be, and from ſome Alteration of the State of the Veſſel itſelf: The Blood, indeed, ſeemed to be about ſtagnating; but this I ſubmit to your Judgment, who are ſo well acquainted with the Laws of *Hydroſtatics*.——It came into my Head, that I had ſeen a Drop of Water proceed ſomewhat like it, in its Deſcent on a ſmooth dry Surface (as a glaſs Plate held nearly perpendicular); and, on Trial, I found the Drop to proceed in a kind of *Meatus*, not altogether unlike the Motion of the ſaid Globules. In the Courſe of the Blood from *A* to *B* (ſee Fig. 2. Tab. V.) ſometimes a Current would turn off to the Branch at *a*, for a good while together, then ceaſe to do ſo, paſſing on to *B*; and leaving the Branch *a* empty: and then again you might ſee it fill the Branch again: This I ſaw ſucceſſively ſeveral Minutes together. If you think this worth communicating to the Royal Society, as an Experiment capable of Improvement by Perſons of more Leiſure, and better Skill, it is at your Service.

I would only mention to you ſome of the Difficulties I met with, and tire you no longer.——

At firſt it was no eaſy Matter to make a Creature, coming out of ſo cold an Element, bear even the *reflected* Rays of the Sun, when converged, though

far

ſar enough from the *Focus*; for I was obliged to make uſe of a Looking-glaſs becauſe of the Sun's Poſition: I once, indeed, tried to perform it without, but found the direct Rays too hot; but a Glance or two I had of it, convince me it might be ſeen to much greater Perfection.——Another Difficulty is, that the Tube is rather too thick, and beſides is apt to be ſmeared with the Tail of the Animal: However, it requires Time and Patience to perform it; yet, in the Manner I have ſeen it, it is to me the moſt entertaining Sight my Eyes ever ſaw.——I am not without Hopes, that I ſhall be able to remove ſome of the Difficulties myſelf, if GOD give Health and Opportunity this Summer; if not, I wiſh a fitter Perſon may attempt it, and ſucceed: It may be uſeful, perhaps, as well as pleaſing. I am

*Your moſt obliged,*
*and humble Servant,*

Tooting, March 31. 1741.

H. Miles.

I forgot to mention, that the Blood appeared a little diſcoloured, but not more in Proportion than it appears to be when you view it in the common way; and that the Tube, with the *Lens* receiving the Sun's Rays, was exactly parallel with the Horizon, and perpendicular to the Plane of the Screen which received the Image.

## XIV. *A Letter from the Rev^d* Ebenezar Latham, *V. D. M. and M. D. to* C. Mortimer, *M. D. S.* R. S. *concerning the true* Delineation *of the* Aſteriſms *in the* antient Sphere.

*SIR*,

I Was obliged, by the Favour of yours, with Number 447. of the *Tranſactions*, by which I find we have the Globe of the Heavens already contrived for the Uſe I intended. I never heard of Mr. *Senex*'s Invention, *ib.* N° 447. before the Hint yours gave me, and am pleaſed with the Opportunity I had of producing it to the World. It is many Years ſince I firſt thought of this Method, and have often ſuggeſted it to ſome Students. The Diſpute that aroſe about Sir *Iſaac Newton*'s Chronological Index, communicated by Abbé *Conti*, confirmed my Opinion of the Advantage that would attend it; eſpecially the Admonition our learned Dr. *Halley* gave Father *Souciet*, (" to inform " himſelf in the *Sphériques*, ſo as to give us the right " Aſcenſion of the Stars truly from their given Lati- " tude and Longitude") made me yet more ſenſible how neceſſary ſomething of this kind was, to let common Readers into the Merits of the Controverſy. But it was perfectly accidental, that I ever preſumed to mention at all to your *Learned Body*, this Alteration in the Conſtruction of the Globes, which I had ſo often wiſhed might obtain for the Uſe of ſeveral Sciences. You will receive, with this, one Scheme, among ſeveral, which I have projected, that is neareſt Mr. *Senex's*, and leaſt defaces the Globe, which I ſubmit to your Judgment, as to the Conveniences that attend it.

TAB. VI.

Fig. I. A Vertical Section of the Globe.

P. P. *The Poles of the diurnal Motion.*

A. *The Axle of the Globe, which terminates in the Poles of the Ecliptic, and receives the other End of the Braſs Arms upon each of its Pivots.*

Æ. *A braſs Equator fixed to the brazen Meridian.*

K. K. *A Key, which, on Occaſion, being put through a Hole in the Brazen Meridian, is juſt over the Place where the Poles of the Ecliptic paſs, by means of a ſquare Hole in the Head of a Screw, ſerves to fix that End of the Braſs Arm, or give it Liberty to move with Eaſe: And the Key, being left in when the Screw is ſlackened, will hinder the Globe from moving on the Poles of its diurnal Motion, till you have adjuſted it to your Mind, ſtraitened the Screw again, and taken out the Keys; as may be ſeen more plainly in,*

Fig. II. Which is nothing but the Windlaſs Part, or the Arm, Pole, and Part of the ſtrong Axis of the Globe, with the Screw and Key more at large, and ſeparate from one another for the more diſtinct View.

If I may take the Liberty to add any thing farther on this Head, next to the accurate Obſervation of the *Britiſh Catalogue* in placing the Stars themſelves, it ſhould be the Revival of the *antient Figures* and *Colours*, as far as we can recover them. It is certain the Invention was very antient, if we ſuppoſe the Deſcriptions *Eudoxus* has given us, taken from Obſervations long before his Time, when the Solſtitial Colure paſſed through the Middle of the *Great Bear*, and the *Crab* through the Neck of *Hydra*, and cut *the Ship* between the Poop and the Maſt, *&c.*——Now I have mentioned *the Ship*, you will indulge a Conjecture, that the Situation of this [ juſt on the Horizon (where they imagined the Sea) in an erect ſailing Poſture for ſome Eaſtern Expedition, and terminating their fartheſt View to the South ], may both give ſome Light into their *Latitude*, that impoſed this Name, and (from that, which muſt have been the Place of the Pole to anſwer this Form) *the Æra of Time*, wherein it was done; for, in the preſent Diſpoſition, the Inhabitants of *Greece* could not have a proper View of that Conſtellation, or be led to form it in the Manner the Antients have done. I ſhall not here urge all the Difficulties in the old Deſcriptions, that might have a Solution from this Method; but if an Alteration could be made either in the *Colour* or *Attitude* of the *Figures*, to anſwer them better, it would add to the Pleaſure of reading ſome Authors, and, together with that new Conſtruction, might afford us ſuch a View of the Heavens, as Mr. *Addiſon* had of *Italy*, when he made the Tour of it with the Claſſics in his Hands: And, ſince I have brought thoſe Writings into the Account, you will allow me to cite ſome Paſſages, which might receive both *Truth* and *Beauty* from ſuch an Improvement: Where *Homer* ſays,

> Πληϊάδας θ᾿ Ὑάδας τε, τό τε σθένος Ὠρίωνος,
> Ἄρκτον θ᾿, ἣν καὶ ἄμαξαν ἐπικλησιν καλέουσιν,
> Ἥτ᾿ αὐτοῦ στρέφεται, καὶ τ᾿ Ὠρίωνα δοκεύει,
> Οἴη δ᾿ ἄμμορός ἐστι λοετρῶν ὠκεανοῖο.
>
> Ιλιαδ. Σ. 487.

> The *Pleiads*, *Hyads*, with the Northern Team,
> And great *Orion*'s more refulgent Beam;
> To which around the Axle of the Sky,
> The *Bear* revolving points *his* golden Eye,
> Still ſhines exalted on th' ethereal Plain,
> Nor bathes *his* blazing Forehead in the Main.
>
> *Pope.*

Mr. *Pope*, amidſt a ſmall Miſtake of the *Sex*, keeps only the Forehead above Water; but the Poet ſeems to exempt her intirely; and ſo does *Virgil*, when he makes *Fear* account for the ſame *Phænomenon*, that *Ovid* (who preſerves all the Fable of the Antients) aſcribes to *Force*.

> *Maximus hic Flexu ſinuoſo elabitur Anguis*
> *Circum, perque duas in morem fluminis Arctos:*
> *Arctos Oceani metuentes Æquore tingi.*
>
> Virgil. Georg. Lib. I. 244.

> Around our Pole the ſpiry *Dragon* glides,
> And like a winding Stream the *Bears* divides,
> The Leſs, and Greater, who by Fate's Decree
> Abhor to dive beneath the † *Southern* Sea.
>
> *Dryden.*

---

† Northern.

*Nuper honoratas ſummo mea Vulnera Cælo*
*Videritis Stellas illic, ubi Circulus Axem*
*Ultimus extremum Spatioque breviſſimus ambit.*
Ovid. Met. Lib. II. 515.

——New Stars you'll ſee,
In this approaching Night's Obſcurity,
With hateful Beams i'th' *Arctic* Circle ſhine.

He immediately adds,

*At vos ſi læſæ contemptus tangit Alumnæ,*
* *Gurgite cæruleo ſeptem prohibete Triones:*
*Sideraque in Cœlo ſtupri mercede recepta*
*Pellite, ne puro tingatur in Æquore Pellex.*
—527.

Ne'er let thoſe ſpurious Stars approach the Deep,
Nor in the purging Ocean's Boſom ſleep,
But their eternal Stain, their whoriſh Tincture keep.

And when he deſcribes them as a Team, it is with the ſame Reſerve.

*Tum primum Radiis gelidi caluere Triones,*
*Et vetito fruſtra tentârunt Æquore tingi.*
—171.

Then the Sev'n Stars firſt felt *Apollo*'s Ray,
And wiſh'd to dip in the forbidden Sea.

All which is a proper Hint for the *Diſpoſition of the Globe*, that muſt correſpond to theſe *Appearances* then, and which can only be obtained by this Method: By the Help of which we may alſo apprehend the Light theſe Deſcriptions give us *into the Age of the Writers*. I may illuſtrate this from *Heſiod*'s Account of *the Seaſons*, of which we have not only a better Idea by this artificial Diſpoſition of the Globe to anſwer them, but alſo of *the Time* wherein he lived, when we come to adjuſt the Heavens to the accurate Inſtructions he gives us, according to his Latitude at *Aſcra*, allowing 50″ *per Annum* for the apparent Motion of the Stars.

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* In the *Ordeal* by Water, it was adjured, not to receive the Guilty, in Terms like theſe.

*Εὖτ' ἂν δ' ἑξήκοντα μετὰ τροπὰς ἠελίοιο*
*Χειμέρι' ἐκτελέσῃ Ζεὺς ἤματα, δή ῥα τότ' ἀστὴρ*
*Ἀρκτοῦρος προλιπὼν ἱερὸν ῥόον ὠκεανοῖο,*
*Πρῶτον παμφαίνων, ἐπιτέλλεται ἀκροκνέφαιος.*
Ἡσιόδ. Ἔργ. Βιβλ. β'. 182.

When the glad Sun, approaching with his Rays,
Has from the Tropic run out Sixty Days;
*Arcturus*, riſing from his ſacred Bed,
Is firſt diſcover'd in the Ev'ning Shade.

*Εὖτ ἂν δ' Ὠρίων καὶ Σείριος ἐς μέσον ἔλθῃ*
*Οὔρανον, Ἀρκτοῦρον δ' ἐσίδῃ ῥοδοδάκτυλος Ἠώς.* 227.

But when *Orion*, and the *Dog-Star*, come
To the Mid-region of the heav'nly Dome,
The Morn, that bluſhing draws away the Night,
Beholds *Arcturus* in the dawning Light.

If we fix the Pole almoſt in the Mid-way between the Star in the Shoulder of the leſſer *Bear*, and another of the *Serpent*, we ſhall have the Satisfaction to obſerve all theſe *Phænomena* anſwer the Deſcription.

tion. I ſhall not enter into the Calculation; for I would not anticipate the Pleaſure, one, that hath no Notion of the Age of *Heſiod*, muſt have, when he finds himſelf able, with ſo much Eaſe and Preciſion, to determine it by theſe Characters *.

*Heſiod*'s Account of the *Pleiads* is too particular not to demand our Attention, and require an Explanation in the ſame way †.

Πληϊάδων Ἀτλαγενέων ἐπιτελλομενάων
Ἄρχεσθ' ἀμητοῦ, ἀρότοιο δὲ δυσομενάων.
Αἳ δή τοι νύκτας τε καὶ ἤματα τεσσαράκοντα
Κεκρύφαται. Ἡσιοδ. Ἐργ. Βιβλ. ϐ. 1.

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* Since I wrote this, I had the Pleaſure to find *Scaliger* concur with me—

*Heſiodus florebat eo Sæculo, quo Arcturus ἀκρόνυχος oriebatur in Bœotia, viij Die Martii. Si quid hoc ad Conjecturam facit, ſaltem apud excellentes Aſtrologos, qui ex hoc Parapegmate infra ſeptuaginta plus minus Annos Sæculum Heſiodi deprehendere poſſunt. Animadverſ. in Chron. Euſebii*, p. 67. Edit. Lugd. Batav. 1606 —

The following Paſſage in Sir *Iſaac Newton*'s Chron. p. 95. hath come to my Hands ſince the former. "*Heſiod* tells us, that, 60 Days " after the Winter Solſtice, the Star *Arcturus* roſe juſt at Sun-ſet; " and thence it follows, that *Heſiod* flouriſhed about 100 Years after " the Death of *Solomon*, or in the Generation or Age next after the " *Trojan* War, as *Heſ.* himſelf declares."

'Tis what we may compute by the preſent Globe; for, bringing *Arcturus* to the Eaſtern Horizon, the Sun we ſhall find in the Ninth Degree of *Aries*. Now it enters ♑ *Dec.* 11. and 60 Days after, or *Feb.* 10. it is in ♓ 2°. 30'. when allowing for the Northern Latitude of *Arcturus* to make it viſible on the Horizon, its Longitude muſt have been ♍ 14°. *&c.* whereas its Place now is about ♎ 20°. [illegible]. And the Difference both ways one Sign 6°. 18'. *&c.* which makes him to have lived 2614 Years ago.

† *Hiſce Signis veteres Agricolæ, & ex eorum Traditionibus Scriptores rei ruſticæ, nec non & Medici, Poetæ, & Hiſtorici ſunt uſi ad Anni Tempeſtates deſignandas*, &c. Greg. Aſtron. p. 130.

Begin the Harveſt, as the *Pleiads* riſe,
And take the Plough, when they withdraw the Skies;
For Forty Days and Nights their glimm'ring Light,
Obſcur'd to us, no longer chears the Sight.

To this I might add *Homer*'s Image of the *Dog-Star*, but eſpecially the exact Deſcription in *Heſiod.*

*Ἀστέρ' ὀπωρινῷ ἐναλίγκιον, ὅς τε μάλιστα*
*Λαμπρὸν παμφαίνῃσι λελουμένος ὠκεανοῖο.* Ἰλιάδ. Ε'. 5.

Like the red Star, that fries th'autumnal Skies,
When freſh he rears his radiant Orb to Sight;
And, bath'd in Ocean, ſhoots a keener Light.

*——δὴ γὰρ τότε Σείριος ἀστὴρ*
*Βαιὸν ὑπὲρ κεφαλῆς κηριτρεφέων ἀνθρώπων*
*Ἔρχεται ἠμάτιος, πλεῖον δέ τε νυκτὸς ἐπαυρεῖ.*
Ἡσιόδ. Ἔργ. Βιβλ. β'. 35.

For then the *Dog-Star* governs in his Courſe,
Walks o'er the Heads of Men, who feel his Force,
Comes in the Day, but chiefly ſhares the Night.

How beautifully does the ſame Writer expreſs the Geſture of *Orion*, as he is following the *Pleiads?*

*Εὖτ' ἂν Πληϊάδες σθένος ὄβριμον Ὠρίωνος*
*Φεύγουσαι, πίπτωσιν ἐς ἠεροειδέα πόντον.* 237.

The *Pleiads*, flying from the threat'ning Scourge
Of ſtrong *Orion*, plunge into the Surge.

Perhaps this may give ſome Light to a Paſſage of *Virgil*, that hath very much puzzled his Commentators.

*Taygete ſimul Os terris oſtendit honeſtum*
Pleias, *& Oceani ſpretos pede reppulit Amnes:*
*Aut eadem* Sidus fugiens, *ubi Piſcis aquoſi*
*Triſtior hybernas Cœlo deſcendit in Undas.*
Georg. Lib. 4. 232.

Firſt, when the pleaſing *Pleiades* appear,
And ſpringing upward ſpurn the briny Seas:
Again when their affrighted Choir ſurveys
The watry *Scorpion* mend his Pace behind,
With a black Train of Storms, and Winter-wind,
They plunge into the Deep, and ſafe Protection find.
*Dryden.*

Some, I know, by this *Sidus* underſtand the *Southern Fiſh*, others the *Hydra*, and ſome the *Sun*; but how Mr. *Dryden* came to inſert *Scorpio*, I ſhall not inquire. Nor ſhall I trouble you with any Conjectures with regard to the *antient Figures*: It is certain there have been *Variations* in this reſpect, ſince *Ptolemy* mentions a Star in the Horn of *Aries*; and it is thought *Hipparchus* reckoned one, that is now in the Line, to the firſt Foot of *Aries* *. Whether the Epithet *Ovid* gives *Capella*, does not imply ſome little Difference, in the Situation of it, from ours, I leave to the Critics.

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* Since I wrote this, I find Sir *Iſaac Newton*, in this way, recover to their former Places the Stars below, by rectifying the Delineation.
" In the extreme Flexure of *Eridanus*, a Star of the Fourth Mag-
" nitude, of late referred to the Boſom of *Cetus*.
" In the Head of *Perſeus*, a Star of the Fourth Magnitude.
" In the Right Hand of *Perſeus*, a Star of the Fourth Magnitude.
" In the Neck of *Hydrus*, a Star of the Fourth Magnitude.
" In the Left Hand of *Cepheus*, one of the Fifth Magnitude."
All whoſe Characters he deſigns from *Bayer*.

——*Et* Oleniæ *Sidus pluviale Capellæ,*
*Taygetenque, Hyadaſque Oculis, Arctonque notavi.*
Met. Lib. III. 594.

——I began to note
The ſtormy *Hyades*, the rainy * *Goat*,
The bright *Taygite*, and the ſhining *Bears*,
With all the Sailors Catalogue of Stars.

I might inſiſt on the Etymology of *Arcturus*, and others; for it appears from the Accounts the Antients themſelves give us, there was not always the greateſt Uniformity in their Drawings. *Ovid* ſays of *Bootes*,

——— ——— ———*& te tua Plauſtra tenebant.*
Lib. 2. 177.

Nay, and 'tis ſaid, *Bootes*, too, that fain
Thou would'ſt have fled, though cumber'd with thy Wain. *Addiſon.*

And he lets us know, that *Scorpio* took up 60°.

*Eſt Locus, in geminos ubi Brachia concavat Arcus*
Scorpios; *& Cauda, flexiſque utrinque Lacertis,*
*Porrigit in Spatium Signorum Membra duorum.*
——195.

There is a Place above, where *Scorpio*, bent
In Tail, and Arms, ſurrounds a vaſt Extent;
In a wide Circuit of the Heav'ns he ſhines,
And fills the Space of Two celeſtial Signs.

This might be one Reaſon of that Compliment which *Virgil* paid *Auguſtus*, apart from the other, which *Scaliger* aſſigns.——

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[*] Elbow'd.

*Anne novum tardis ſidus te menſibus addas,*
*Qua locus Erigonen inter, Chelaſque ſequentes*
*Panditur? ipſe tibi jam Brachia contrahit ardens*
Scorpius, *& Cœli juſta plus parte reliquit.*
Georg. Lib. I. 32.

Where in the Void of Heav'n a Space is free,
Betwixt the *Scorpion*, and the *Maid*, for thee:
The *Scorpion*, ready to receive thy Laws,
Yields half his Region, and contracts his Claws.

It's true, this Poet knew *Libra* very well; but, perhaps, it made no great Figure among the *Aſteriſms* then.

Libra *die ſomnique pares ubi fecerit horas,*
*Et medium Luci, atque Umbris jam dividet Orbem.*
——208.

But when *Aſtræa*'s Balance, hung on high,
Betwixt the Nights and Days divides the Sky.
*Dryden.*

How *Taurus* was *painted* at that Time, we learn from his Deſcription.

* Candidus auratis *aperit cum* Cornibus *Annum*
Taurus, *&* averſo *cedens Canis occidit Aſtro.*
——217.

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* By reaſon the Firſt Month of the old Luni-ſolar Year (on account of the intercalary Month) began ſometimes a Fortnight after the Æquinox. This may, perhaps, account better for the Propriety of *Virgil*'s Expreſſion *Aperit Annum*, than any of his Commentators have done.

When with his golden Horns, in full Career,
The *Bull* beats down the Barriers of the Year;
And *Argos*, and the *Dog*, forſake the Northern Sphere.

In the laſt Verſe we have, perhaps, no Occaſion for *Heinſius*'s Correction of *adverſo*, if we compare the Diction here with *Ovid*'s.

*Per tamen adverſi gradieris Cornua Tauri.*
Met. Lib. II. 80.

The *Bull's* oppoſing Horns obſtruct the Way.

The Inſtructions *Virgil* gives in the ſame Place, as to Husbandry, are beſt underſtood from this new Diſpoſition, and may render us ſenſible how much earlier theſe *Phænomena* were then in the Year, to what they are at preſent[*].

*Ante tibi Eoæ Atlantides abſcondantur*, &c.
Georg. Lib. I. 221.

But if your Care to Wheat alone extend,
Let *Maia* with her Siſters firſt deſcend,
And the bright *Gnoſian* Diadem downward bend.

I know we cannot depend upon all the Exactneſs in a Poet, that might be expected from an Aſtronomer: But *Virgil* ſeems to have made it his favourite Study.

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[*] *Paulatim Obſervatio hujus Ortus & Occaſus neglecta jacet, nec ab aliis uſurpatur, quàm à Poëtis, qui tempora per Circumſtantias tam varii Ortus & Occaſus tot Syderum (quibus nihil pulchrius) deſcribere, & veluti pingere ſolent, quamvis plerumque erroneè, quippe qui Calendarii noſtri Diem per ejuſdem Stellæ Ortum deſcribunt nunc, per quem deſcribebatur tempore Cæſaris, cùm tamen tempora diſcrepent 14 diebus ferè.* Greg. Aſtron. p. 132.

*Me vero primum dulces ante omnia Muſæ,*
*Quarum ſacra fero ingenti percuſſus Amore,*
*Accipiant; Cœlique Vias, & Sydera monſtrent.*
Geo. II. 475.

Would you your Poet's firſt Petition hear,
Give me the Ways of wand'ring Stars to know.

*Ovid* appears alſo perfectly acquainted with the antient Figures, and the moſt accurate way of *delineating* them, at the ſame time that he enlivens them with their *Fictions.*

*Conſiſtuntque Loco, Specie remanente Coronæ,*
*Qui* medius nixique Genu, anguemque tenentis.
Met. VIII. 181.

———————— The Crown retains
Its proper Figure, and a Station gains
Where *Hercules* in bending Poſture ſtands,
And ſtrives to gripe the *Dragon* in his Hands.
*Vid.* Lib. XIV. 846.

How he came by the Account, it is not material to inquire; but there is *one Line*, wherein he ſeems to have preſerved ſome antient Tradition, as to the *Pole.*

*Quæque* Polo *poſita eſt glaciali* proxima *Serpens.*
Lib. II. 171.

The folded *Serpent* next the frozen Pole.

And there is Reaſon to believe one of the Stars of that *Conſtellation* was the *antient Polar Star*, and might firſt give Riſe to the Denomination; for one in the *Tail of the Dragon*, of *the Third Magnitude*, comes neareſt it of any other. About the Time of *the Flood*, it was within 10′ *of the Pole*, and might paſs for the *Polar Star* a Thouſand Years after among thoſe Writers, from whom *Ovid* copied his Expreſſion. However, this is certain, that *another Star* of that Conſtellation, one of the Fourth Magnitude, was really nearer than any other, when the old *Obſervations* were made, which literally juſtifies *Ovid*'s Account. I might take notice of his exact Repreſentation of the Diſpoſition of *the Ara*, and *Anguis*, when he makes them the Two Extremes.

——— ——— ———*Medio tutiſſimus ibis:*
*Neu te dexterior tortum declinet in Anguem,*
*Neve ſiniſterior preſſam Rota ducat ad Aram.*
*Inter utrumque tene.*——— ib. 137.
The middle Way is beſt.
Nor where in radiant Folds the *Serpent* twines
Direct your Courſe, nor where the Altar ſhines.
Shun both Extremes.

But the Inſpection of the Globe, when it is fixed in a proper Poſition, will convey the beſt Idea of all theſe Appearances; for we derive this Advantage from the new Conſtruction of it, that it will enable us to place the ſeveral *Phænomena before every Eye*; by which means thoſe who have the leaſt Acquaintance with theſe Studies, muſt be greatly ſurpriſed and pleaſed to obſerve the antient Accounts minutely verified. It is a ſort of living over again the former Ages, *allowing* $1^{\circ}.\ 23'.\ 30''.$ *for every hundred Years*, according to *Ricciolus* and *Flamſted*, which is a ſort of Mean between the other Computations.

I ſhall not now ſuggeſt ſome other Purpoſes, that might be ſerved by this Method. It is ſufficient to recommend the Invention, that it throws ſo much

Light on the common Claſſics, to which I have confined this Examination, and which muſt be my Excuſe for the Citations. I am, with great Reſpect,

*The* Royal Society's
*and your moſt obedient*
*humble Servant,*

E. Latham.

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## XV. *Lumen Auſtrale* Romæ *obſervatum die* 27 Jan. *An.* 1740. *a* Didaco de Revillas, *Abbate* Hieronym. *P. Math. Prof. &* R. S. S.

COELO undique nubilo, notoque vehementer ſlante, hora poſt Meridiem 6¼, rubeſcens lumen inter gradus 45 & 55 amplitudinis ortivæ auſtralis apparebat. Maxima ejus ſupra horizontem latitudo gradus circiter 9 æquabat. Parte tamen Cœli horizonti proxima ad unum circiter gradum obtenebrata ſpatium fere parallelogrammum gradus 10 latum, & altum lumini concedebatur; quod in ſuprema parte magis, minus in ima ſplendeſcebat. Inter denſiores nubes altera ſumme nigricans *AB* Tab. VI. Fig. 1. horizonti propemodum parallela, ſupra lumen, meridiem verſus protendebatur.

Poſt horæ ſemiſſem vividius ſenſim micabat ſplendor; ſenſimque iterum minuebatur: quod pluries uſque ad horam 9 obſervatum. Interim tenuis horizonti itidem parallela nubecula *CD* lumen a meridionali plaga interſecans, comparebat. Circa horam 9 nubes aliæ ab orientali verſus meridionalem plagam paullatim procedentes ſplendorem jam langueſcentem obtegebant: & circa horam 9 $\frac{1}{4}$ penitus extinguebant. Poſt horam 12 largus imber decidebat.

Barometrum toto hoc tempore ad altitudinem pollicum Pariſin. 27. 9 $\frac{1}{4}$ conſiſtebat. Thermometrum mercuriale (quod in aqua ebulliente notat gr. 0.; in nive vero ſalis communis duabus quintis partibus permixta, gr. 180) deſignabat tunc temporis gr. 141.

Monemus interea lumen hocce nedum ſplendidius, verum & eminentius viſum eodem tempore, & ad eandem plagam ab nonnullis *Viterbio* ad Urbem accedentibus, ac ab aliis in Via Valeria (hoc eſt, ad orientem Romæ) quinto ſupra viceſimum ab eadem urbe milliario iter facientibus.

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*Corrigenda in* Philoſ. Tranſactions, N° 459.
*Page* 646. *Line* 12. *for* $15^{\circ}\ 02'\ 00''$ *read* 10′.
647. *Line* 7. *for* Oct. 28. *read* 27 Oct.
648. *Line* 9. *for* $15^{h}\ 53'\ 4''$ *read* $15^{h}\ 55'\ 4''$.

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*LONDON:*

Printed for T. Woodward, and C. Davis, over-against *Gray's Inn-Gate* in *Holbourn*; Printers to the Royal Society. M.DCC.XLIV.

# *BOOKS lately Publiſhed by* C. Davis.

I. THE Elements of the Art of Aſſaying Metals. In Two Parts. The firſt containing the Theory, the ſecond the Practice, of the ſaid Art. The Whole deduced from the true Properties and Nature of Foſſils; confirm'd by the moſt accurate and unqueſtionable Experiments, explain'd in the natural Order, and with the utmoſt Clearneſs. By *John Andrew Cramer*, M.D. Tranſlated from the *Latin*, illuſtrated with Copper Plates. To which are added ſeveral Notes and Obſervations, not in the Original, particularly uſeful to the *Engliſh* Reader. With an Appendix, containing a Liſt of the chief Authors that have been publiſhed in *Engliſh*, upon Minerals and Metals.

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V. The Figure of the Earth, determined from Obſervations made by Order of the *French* King, at the *Polar Circle*. By *Meſſ^rs De Maupertuis*, *Camus*, *Clairaut*, *Le Monnier*, Members of the *Royal Academy of Sciences*; the Abbé *Outhier*, Correſpondent of the Academy; and Mr. *Celſius*, Profeſſor of Aſtronomy at *Upſal*. Tranſlated from the *French* of M. *de Maupertuis*.

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Philos. Trans. N° 461 TAB. I.

Fig. 1.

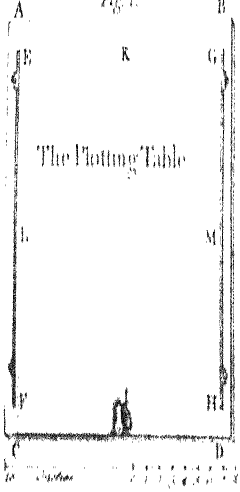
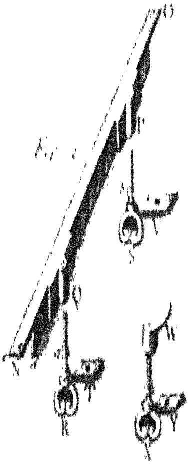


Fig. 2



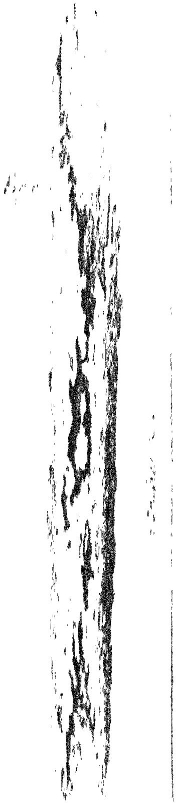


Fig. 3 General Map

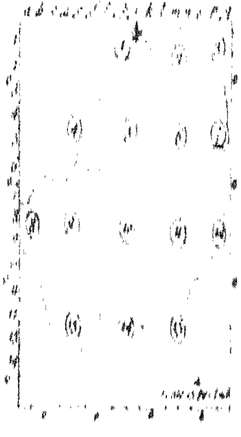


Fig. 4 Particular Map N° IV

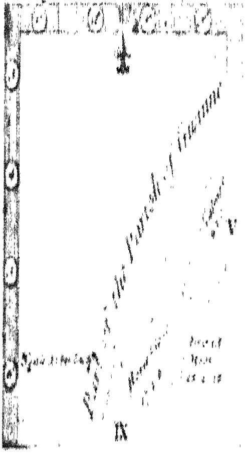


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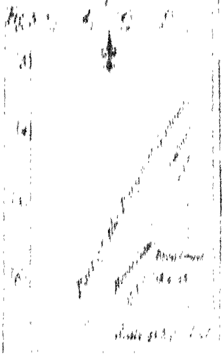
Fig. 5



Henry Beighton F R S inv. & delin. 1741

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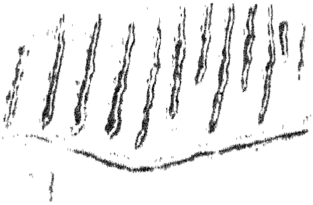

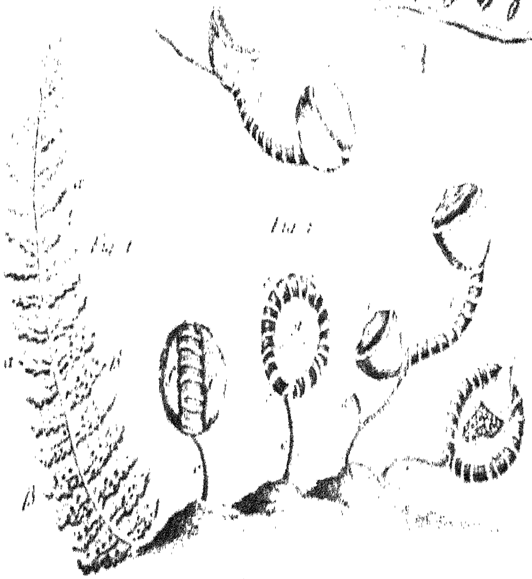

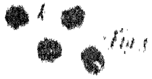

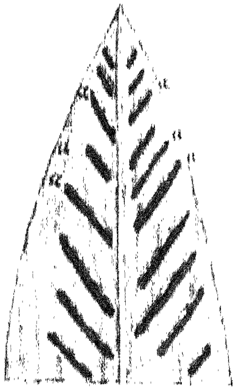

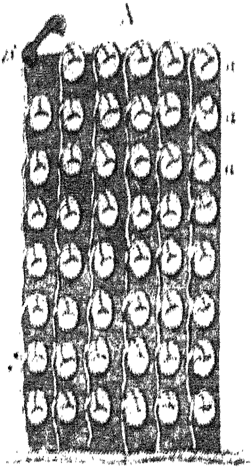

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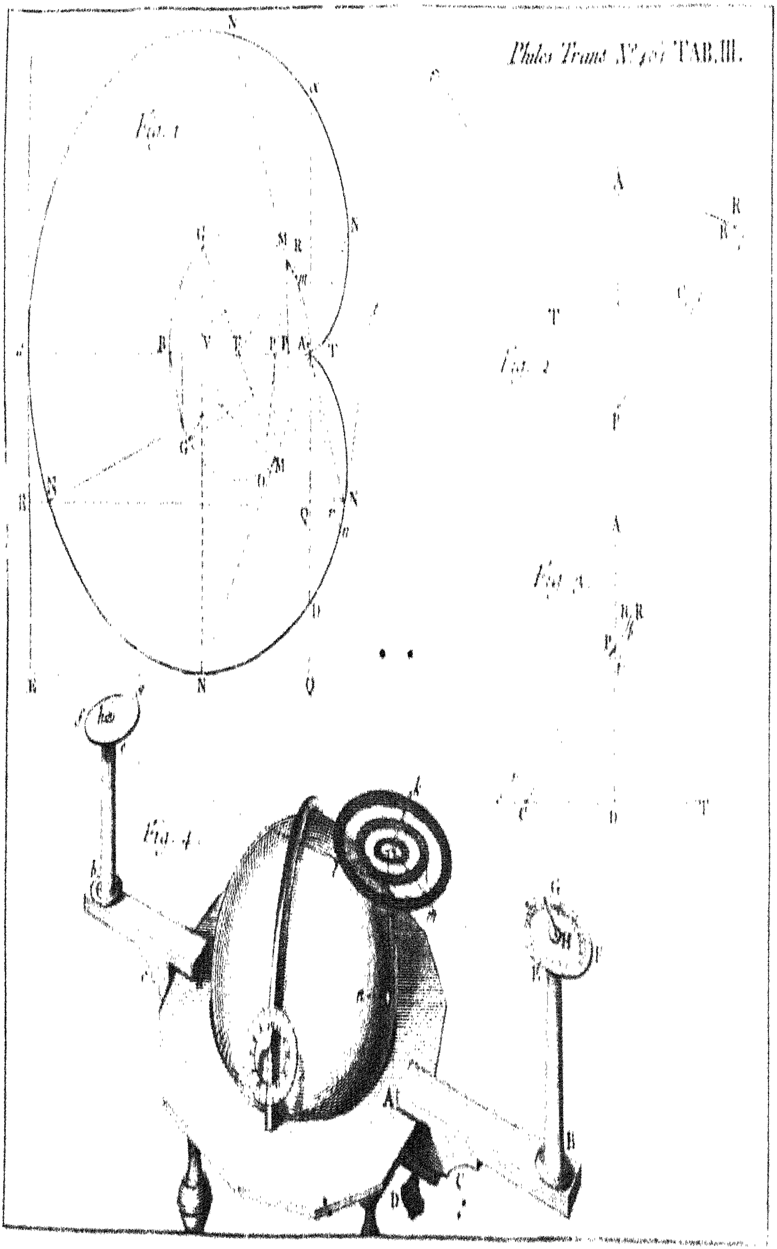

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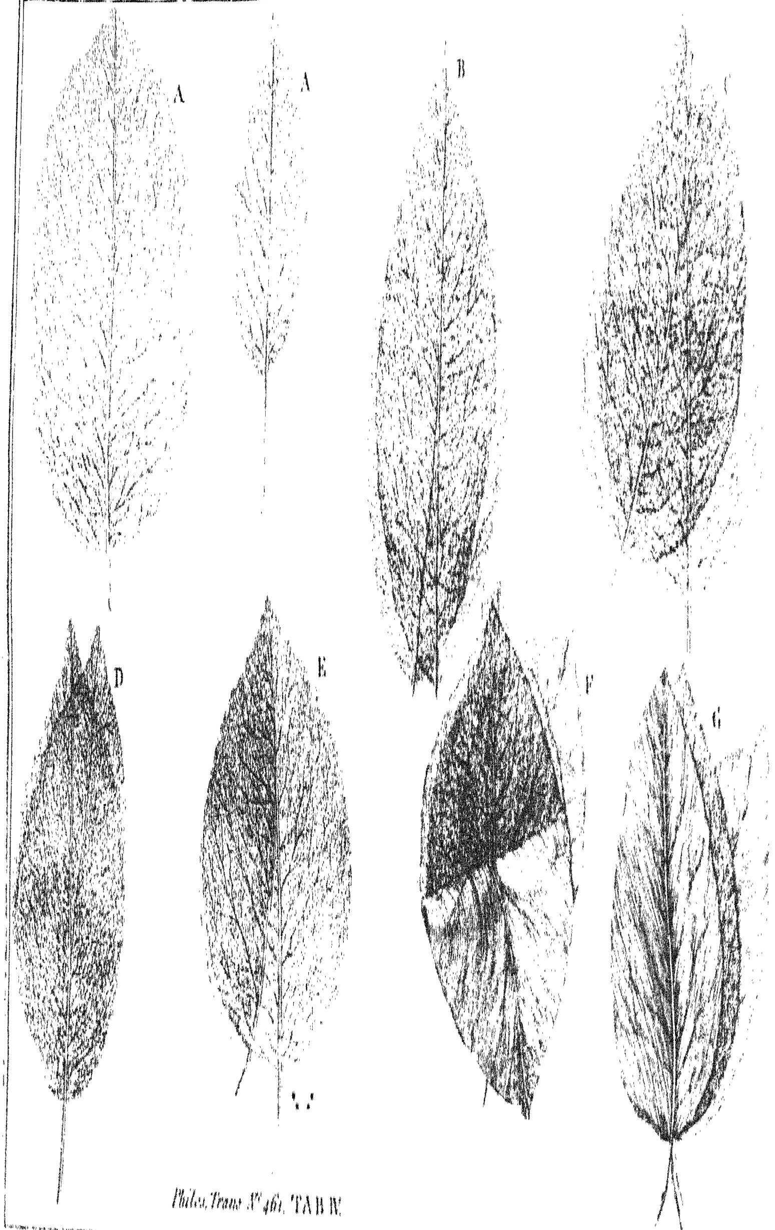

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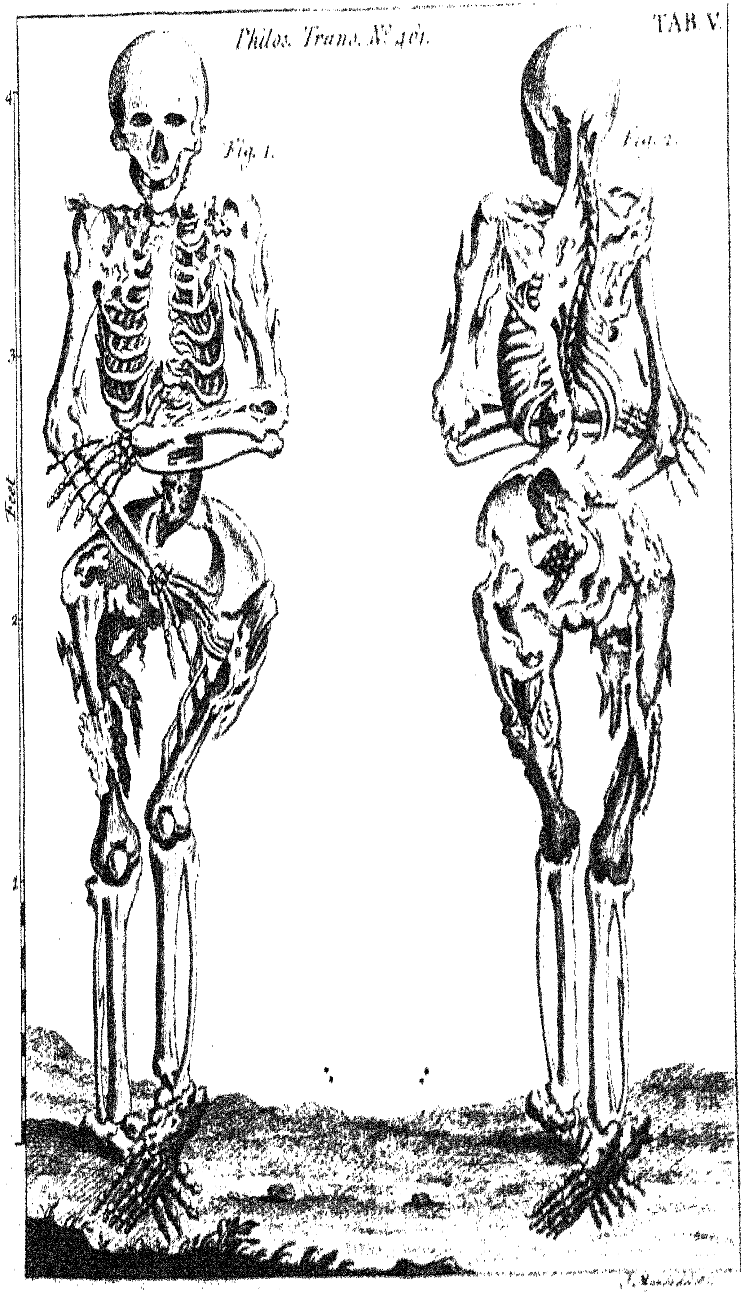
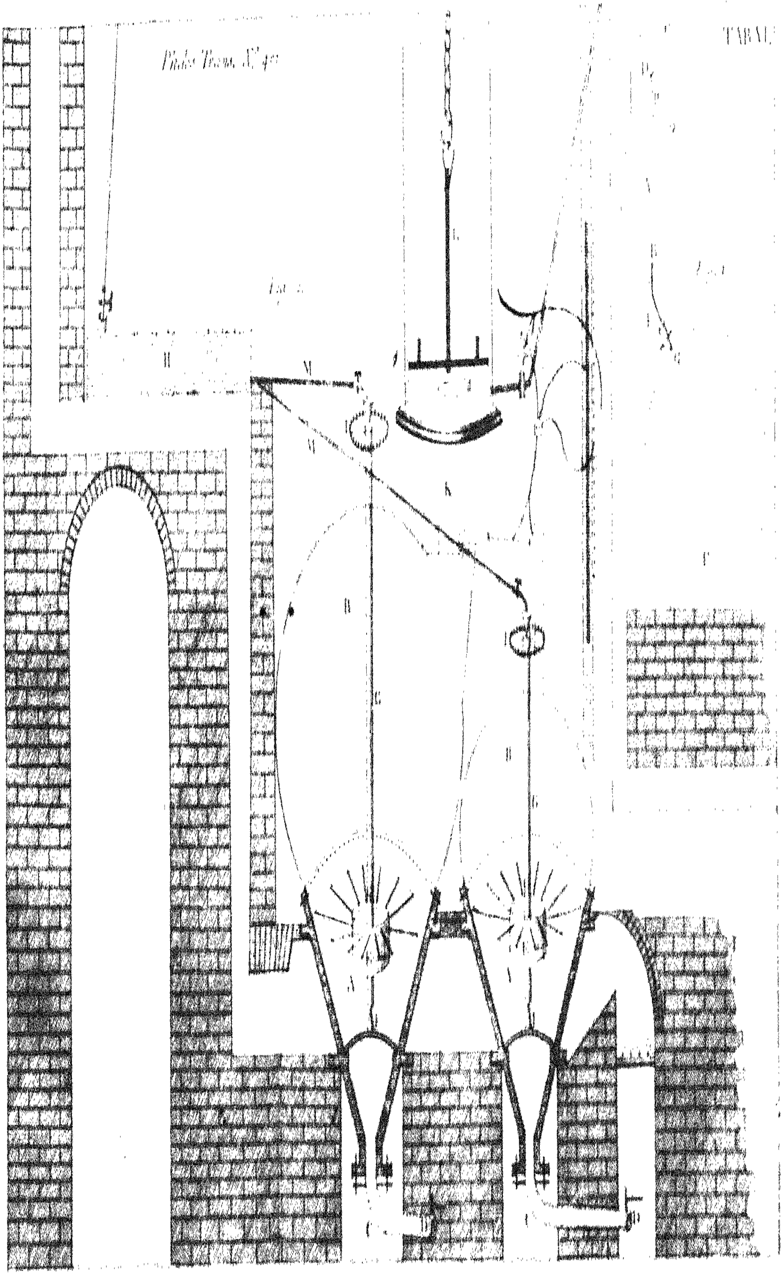
TAB. V.



J. Mynde del. et sc.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TAB. I.

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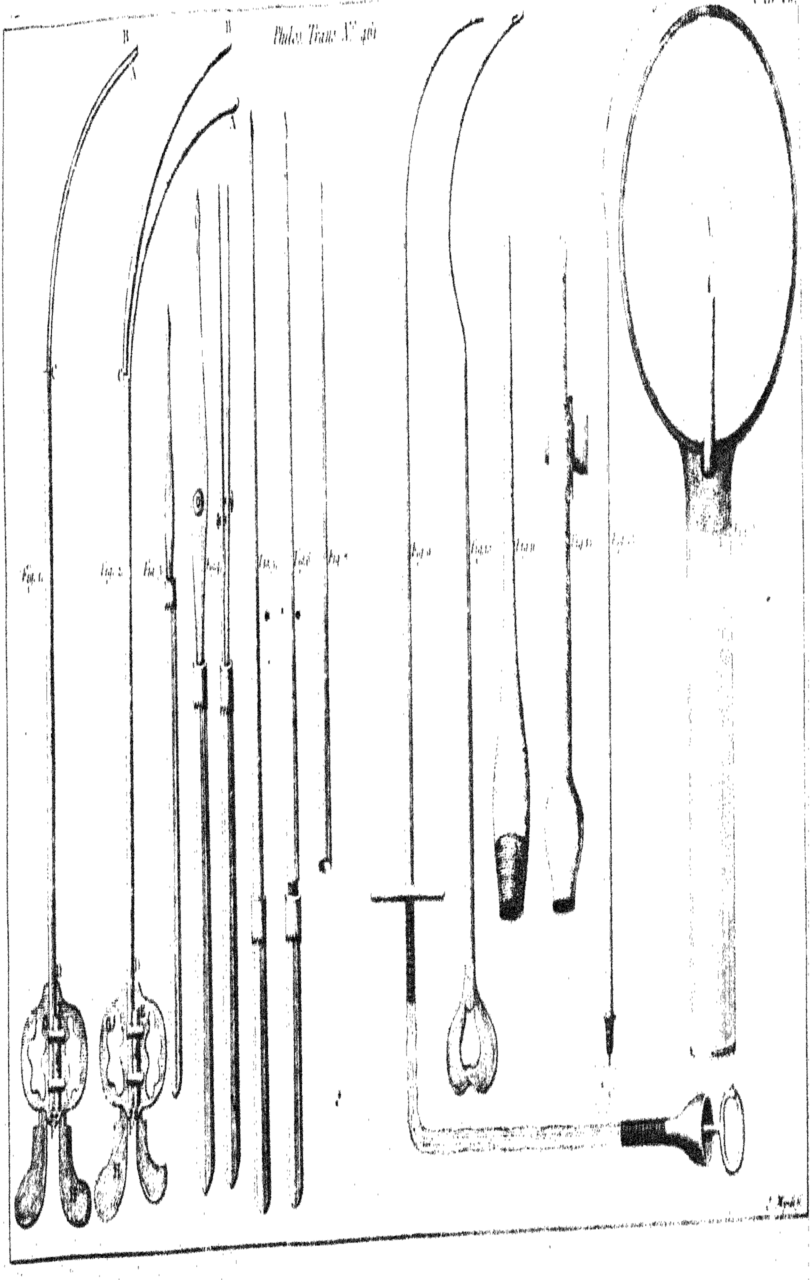
TAB. VII.



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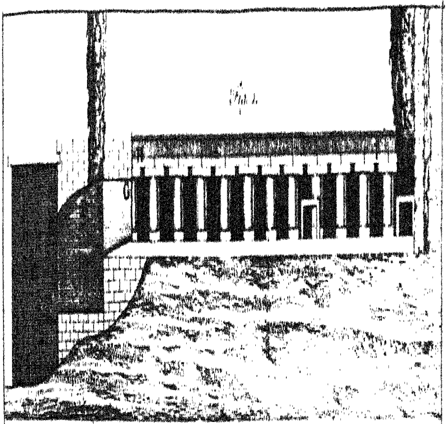

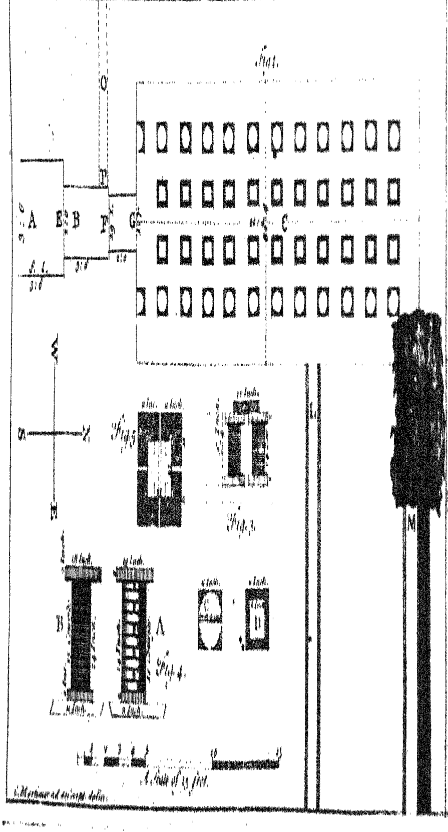

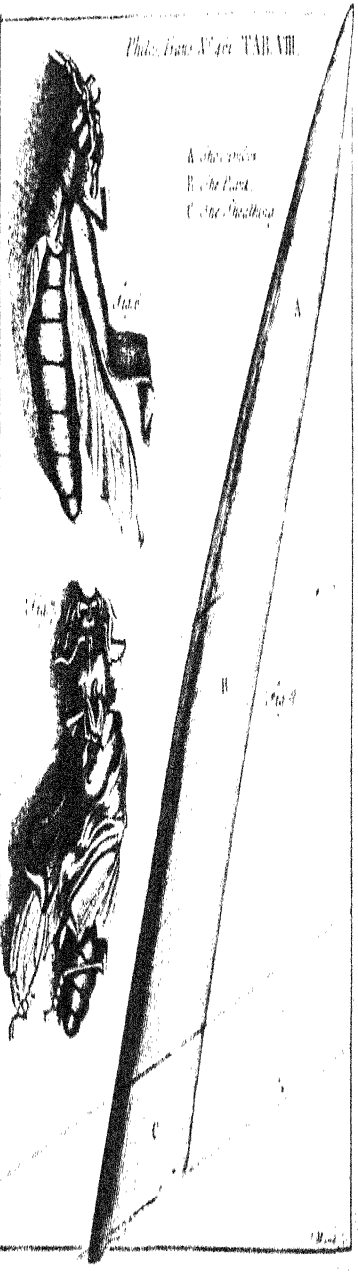

C. Mortimer ad [illegible] delin.

# I. *A new* Plotting-Table *for taking* Plans *and* Maps, *in* Surveying: *Invented in the Year* 1721. *by* Henry Beighton, F. R. S. *Inſcribed to the* ROYAL SOCIETY.

THE principal End and Deſign of Writing or Publiſhing, ſhould be to convey down ſome uſeful Knowledge to the reſt of Mankind, ſince it is what we are indebted, to communicate our Talents, in return for thoſe Helps we have received from others.

Whoever writes on any of the practical Parts of the Mathematics, his chief End and Aim ſhould be, at one or both of theſe Two Things, Certainty and Expedition, wherein conſiſts the very Life and Beauty of a Science.

That Time and Obſervation have produced better Inſtruments or Improvements, is a Truth not to be denied; but at the ſame time that there may be new Inſtruments, and yet worſe, is equally true: The eager Thirſt after, and Humour for Things new, and in Vogue, have ſometimes been the Occaſion of rejecting ſome old Inventions, much ſuperior to the new ones in Practice.

What I have to ſay on the Subject, and to make good what I have been aiming at, ſhall be in the practical Part of Surveying, *viz.* The taking of Plans or Maps. And here, perhaps, I may be thought to need an Apology, in ſeeming to propoſe a new Inſtrument, whilſt I am blaming others for the ſame thing. But when I tell you mine is an old Inſtrument improved: where I have obviated all the Difficulties that hitherto attended it; and made it to anſwer all the Objections that have been raiſed againſt it; and demonſtrate that it is ſubſervient to all Parts of the Art, for which ſuch Inſtruments are deſigned; I may in ſome meaſure ſeem to be ſatisfied.

The Inſtrument is (what has been hitherto called) the *Plain Table*. One of the chief Objections againſt it was, the Difficulty in ſhifting of Papers; for you were almoſt neceſſitated, when you were at work on a Sheet in the Table, to put in all the Work that is to be contained thereon, (becauſe it is very impracticable to put it on the Table in the ſame preciſe Poſition again) and this although it were with the utmoſt Inconveniency, in purſuing ſome grand Station, or circumſcribing the Whole. This is intirely obviated; and I have remedied all the other Objections againſt it (as may be ſeen hereafter), in a very ſimple and eaſy Manner, which I contrived in the Year 1721. for making a correct Map of the County of *Warwick*; by which, with good Succeſs and Expedition, I completed and publiſhed the ſame in the Year 1728. and call the Inſtrument *The Plotting-Table.*

[illegible] *Henry Beighton.*

## *A Deſcription of the* Plotting-Table.

IT is a plain ſmooth Board, about 18 Inches ſquare, and Three-quarters of an Inch thick, as Tab. I. Fig. 1. *ABCD*, made of *Mahogany*, *Walnut*, *Pear-tree*, or *Norway Oak*, well clamped at the Ends, or a braſs Frame round it, to prevent its warping, and, as much as poſſible, ſhrinking and ſwelling.

Within Six-tenths of an Inch of Two of its oppoſite Sides (and parallel to them and one another) are Two Grooves *EF*, *GH*, cut on the Face half an Inch deep, to let in Two braſs Holders in the Shape of *NO*, Fig. 2. which are each of one Piece of caſt Braſs, like Two braſs Rulers, joined together at Right Angles. The perpendicular Part is One-tenth and Three hundredth Parts of an Inch thick, as at *d*, half an Inch deep, and a little ſhorter at each End than the upper Part, which is 17 Inches long, Three-tenths broad, and about Eight Parts of an hundredth of an Inch thick; about Two Inches and an half from each End of the Holder, are thick Parts or Boſſes in the upright Piece, as at *P* and *Q*, through which are Holes tapped, to receive the Skrews *PS*, *QR*, which Screws go each through a braſs Plate as *T* and *V*, fixed by Rivets on the under Side of the Table, and little round Nuts (as at *a* and *b*) put on them, to confine them to their Shoulders in turning in the Plates, that they neither riſe nor fall; theſe Holders muſt go eaſy in the Grooves, to ſink eaſy and even with the upper Surface of the Table. Then, when the Screws enter the Holes of the Holders, by turning *R* and *S* at the ſame time forward, the Holders will fall, and pinch down any Papers, *&c.* that are under them; and, turning backward, will riſe and releaſe them. In the Middle of one End of the Table is a Groove to receive the Braſs *W*, which has the ſame ſort of Screw and Fixing as the other, to raiſe or fall it. But the Groove is quadrantal, that the Holder *W* may on Occaſion be turned ſo as to lie all on the outſide the

Line *L M*, and to cloſe it, in caſe of high Winds, or keeping the Papers down, on Three Sides; and a Fourth might be added, but there is ſeldom any Occaſion for it.

In the Centre of the Table underneath, is fixed a Braſs Socket, ſo truly made, that the Table may, when ſet, turn round truly horizontal. And a Machine covered with Glaſs, in which a Plummet hangs, to ſet the Table level on the parallel Plates, and glaſs Tubes of Spirit of Wine, may be uſed to ſet it horizontal, as any one ſees Occaſion to take them.

To any one of the Four Edges underneath, is ſcrewed a Box and Needle, ſet to the Variation.

There belongs to this Inſtrument, a ſtrong Three-legged Staff, and an Index with plain or teleſcopical Sights, near Two Feet long.

The Papers or Charts, for this Table, are to be either a thin fine Paſtboard, fine Paper paſted on Cartridge-paper, or Two Papers paſted together; cut as exactly ſquare as is poſſible, each Side being nearly 10 Inches and an half long, ſo that they may ſlide in eaſily between the upright Part and under the flat Part of the Holders.

Any one of theſe Charts will be put on the Table any of the Four ways, be uſed, taken out, and changed at Pleaſure: Any Two of them may be joined together ſtill on the Table, if you make each of them meet exact at the Line *L M*, when near one half of each would lie over the Sides of the Table; or by cutting and joining again, the Whole of them will be within the Table. And if Occaſion ſhould happen, as ſeldom it does, by cutting each Paper both Ways through the Middle, Four of them may be put on at one time, meeting in the Centre of the Table.

Each Chart is always croſſed by Right Angles through the Middle, for the Purpoſe above, and to make any of them anſwer to the Guide-Lines on the Table, Fig. 1. *IK*, *LM*, drawn quite through the Centre, and the whole Table.——So the grand Objection of ſhifting Papers is obviated.

### *Its Facility and Diſpatch,*

As alſo its Certainty, compared with any of the moſt celebrated Inſtruments, I ſhall now briefly ſet forth.

But, in order thereto, it may not be improper to to premiſe, or lay down, as *Lemmata*, theſe Three Things:

1. *The eſſential Buſineſs or Aim in ſurveying of Lands or Countries, is either to have an exact Plan, or to find the* Area *in ſome known Meaſure.*
2. *Every thing that is ſuperfluous or foreign to ſuch Deſign, is better omitted than taken.*
3. *If a true Survey, and exact Plan be made, every Part will have its juſt Proportion, and every Angle its true Opening or Quantity.*

Then what need have we of Degrees, Minutes, *&c.*? They are never made any Uſe of in the Practice of caſting up, or any thing related thereto: For, if from a Station Two Lines be drawn by a good Index to Two diſtant Objects, will it not be the very Angle, and identically the ſame, as if it had been taken by the moſt celebrated Inſtrument, in Degrees and Minutes, and laid down by a Protractor?

The firſt is much more expeditious, eaſy and certain, than the other. More expeditious, becauſe thoſe Two Lines are ſooner drawn than an Angle can be taken, which done, Two thirds of the Work is behind, *viz.* Writing down and Plotting. More eaſy, as done with One fourth of the Trouble. More certain, becauſe one may be liable to Miſtakes in taking the Degrees or Minutes; in ſetting down, and in protracting. And if it ſhould ſo happen, that one numerical Angle ſhould be taken, ſet down, or plotted to the wrong Coaſt, (where they depend on one another) ſo great an Error would enſue, that could not be retrievable, but by going on the Spot, and performing the Operation anew. Now the Plotting-Table, after Two Stations, proves every thing on the Spot: for, from every Station you are upon, the Index muſt point at the ſame time to any Station on your Map, and its correſponding Object in the Field; which is a demonſtrative Proof, for nothing but Truth will agree.

In ſeveral Branches of the Mathematics, it is abſolutely neceſſary to take Angles in Degrees, Minutes, and their Subdiviſions, as Aſtronomy, Trigonometry, Navigation, Longimetry, inacceſſible Heights and Diſtances, *&c.* and alſo in taking large Plans, to calculate and prove Things by Trigonometry; which would not only be a Work of Curioſity, but very commendable. But where the Nature of the Thing will admit of as good Proof, with One-tenth-part of the Trouble and Time; it would be like running the

Solution of an eaſy Queſtion into a long Proceſs of Algebra or Fluxions, when the plain Rule of Proportion would juſtly anſwer the ſame.

It is objected, That, in ſurveying by the Plotting-Table, the ſhrinking or ſwelling of the Papers, are a great Inconveniency.

In Anſwer to this, it may be ſaid, The ſame Inconveniency attends the ſurveying by any other Inſtrument, ſo ſoon as it is plotted; for both Velumn and Paper will ſhrink and ſwell in the Houſe on the Alteration of Weather (as well as all Bodies); for a Line of 48 Chains, plotted by a Scale of 3.2 *per* Inch, in a hazy Morning, in a clear Afternoon the ſame Day, meaſured but 47 and an half: And there are various Shrinkings and Swellings, according to the Weather, and Difference of Paper, *&c.*

In the Plotting-Table this Inconveniency is in a great meaſure remedied. For in what State ſoever of the Weather you put Lines on the Chart, the Holders give Marks on the Chart as it then ſtood; if it was moiſt and ſwelled up in the middle Part, you may, when you either caſt up or meaſure Lines, by laying it on a damp Floor, put it in the ſame Condition as it was when you plotted the Lines. If you plotted in dry hot Weather, and are caſting up in damp or moiſt, a little heating by the Fire will reduce it to the ſame State again. Another Remedy I have long uſed is, to plot and meaſure by Scales of the ſame Paper, which will ſhrink or ſwell in proportion as your Map does.

But it will be well to obſerve here, that the Shrinking and Swelling alters the Lines only, and not at all the Angles: For, let a Polygon be never ſo much uniformly extended or contracted, each Angle muſt contain the ſame Number of Degrees and Minutes as before. Hence this Objection falls no harder on the Table, than on all other Inſtruments.

And here I intended to have ended this Diſcourſe: But as I have ſome other ſmall Improvements, not only in the Inſtrumental Part, but in a new Method of diſpoſing the Maps, and better adapting them to all ſubſequent Uſes; I proceed.

I ſhould have ſaid before, that each Chart has a *Flower de Lys* on its North Edge; and, as the Needle is moveable to any Side, Care muſt be taken, that the North End of the Needle, when it ſtands, ſhould point the ſame Way as the *Flower de Lys* on the Charts.

I uſe a Needle about Five Inches long, placed in an oblong wooden Box, but juſt ſo wide as the Needle may play double the Degrees of the Variation Weſt, *viz.* 10°. In the Middle of one End is the *Flower de Lys*, and the Box is by Studs and Holes always put on the Table oblique to the Quantity of the Magnetical Variation. I make no other Uſe of the Needle, than to ſet the Table in the Meridian, and to prevent any great Miſtakes, in joining or placing the Charts wrong.

I have no more than half an Inch of the Needle that appears from under the Table, for the Reaſon it ſhould not be in the Way, or ſo ſubject to be damaged: The making the Box ſo narrow, is to check its playing, that it may ſooner hang ſtill over the *Flower de Lys*. The wooden Box, lined with Paper, I find preferable to a large braſs Box, and large Glaſs, which in cold and hazy Weather, condenſes the Vapour and Air ſo much, as to make the Needle very languid and dull.

## *Farther Uſes, by taking a Survey in the new Method by the* Plotting-Table.

The Charts, thus taken, are more readily laid together by Numbers on their Edges, which tally, and make up the whole Map in one Plan, or View, and are, in theſe Squares, more portable.

In the ſecond Place, they are more readily copied, extended, or contracted. For, by having a Frame of Wood that juſt encompaſſes a Chart, divided by 19 Threads at equal Diſtances, and the ſame at Right Angles, the other Way; each Five or Ten, *&c.* being diſtinguiſhed by Silk of a different Colour; a Reet is made of 400 Geometrical Squares, from which, having a Velumn or Paper ſo divided by leſſer or greater Squares; then drawing or copying by Help of the Lines into thoſe new Squares, you have your true Map contracted or extended.

Large Maps of Lordſhips are not any ways convenient, or portable, to have recourſe to on the Spot or Place they repreſent; being ſubject to Damages, unfit to be opened in rainy Weather, very troubleſome in the Wind, and very difficult to find out the Part you want. To remedy all theſe Inconveniences, ſome Years ago I contrived a new Method of diſpoſing them, in ſuch Manner as makes them more ſure, ſafe, ready, convenient, durable, and portable, than any other Method.

And

And this is done by imitating the Geography of the World, which firſt gives the Whole, then the ſeveral Kingdoms, Countries, Provinces, and minuter Parts and Diviſions, ſeverally and more at large.

Firſt, It will be highly neceſſary, that a General *Map* of the whole Lordſhip, Country, &c. be drawn in one Sheet of Paper or Vellum, to give the Form, Idea, and Proportion, that the Parts bear to the Whole, and one another: by which Situations, Bearings of the Towns, Villages, Roads, and remarkable Places, will be ſeen at one View: And this muſt be reduced to ſo ſmall a Scale, as the intended Sheet may comprehend the Whole. A Scale of about 11 or 12 Chains in an Inch, will plot a Lordſhip of more than [illegible] Acres, in the Compaſs of 10 Inches and One quarter Square: which may be a convenient Size to make Two Leaves, and open in a *Folio* Book. This Map may expreſs the Roads, Rivers, Streets, Boundaries, Incloſures, and common Field Lands ſingly, in caſe they be not leſs than 4 or 5 Links in Breadth: The Pieces that contain not leſs than about 10 Acres, will admit of Room to write the Owners Names and Quantities in Statute Meaſure, as in Fig. 4. But for all the ſmall Parts, there will not be room to explain them: Therefore, —

I divide the general Map into as many Geometrical Squares, as I took Charts in ſurveying by the Table, by red Lines, as in Fig. 3. horizontally and perpendicularly, as noted by a,a,a,a, &c. which, by a Scale of 12 *per* Inch, may take about [illegible] Charts in Number: In the openeſt Place near the Middle of each Square, in a ſmall Circle, I number them with red Figures 1, 2, 3, &c. correſponding to the original

Charts: And in the Middle of each of their Sides, Numerical Letters, ſhewing how the particular Maps are to join to each other.

The particular Maps are each as large as the general, and numbered at the Top I. II. III. *&c.* correſponding to the Squares in General, as Fig. 4. where, in the Right Hand Margin, is put V. and at the Bottom IX. ſhewing the Fifth Map tallies to the Side, and the Ninth to the Bottom, or South Part: The general Map being an Index, ſhewing how they join to each other.

By theſe particular Maps may be ſhewn all the leſſer Quantities, with their Tenure, Owners Names, and Contents; and, by the Scale, are capable of ſhewing the Lengths of any Lines, and the Dimenſions, ſo as to diſcover any Encroachments, and record their Shape and Extents to Poſterity: A moſt valuable Uſe of a Survey and Map.

All theſe Maps are bound up in Order, in a Folio Book, to open freely, which will be not only very portable, but uſeful to have recourſe to on any Occaſion; ſecure from Damages of Weather, as well as more durable and ornamental.

The Terriers to theſe Maps are made in the following Manner; either bound in a Book of a Pocket Size by themſelves, or along with the Maps.

The Names of the Freeholders, Copyholders, Cottagers, Tenants, *&c.* are put in an Alphabetical Order.

*Tho. Peter.*

| Refer. to the Map | [illegible] situate in the said [illegible] | Tenure | Free Stat. Meas. | Copy. Stat. Meas. |
|---|---|---|---|---|
| IV. [illegible] 4 | [illegible] the Parish [illegible] *[illegible]* Owner's | [illegible] | [illegible] | [illegible] |
| IV. f. 6 | The House and Homestead called *[illegible]* *[illegible]* Wood [illegible] | [illegible] | [illegible] | [illegible] |
| IV. e. 6 | *[illegible]* *Broad* [illegible] | Freehold | [illegible] | [illegible] |

In this like Manner, under every different Name, may all the Parcels be expreſſed ſeparately.

To find any Piece or Parcel of Land in the Lordſhip readily, firſt find the Tenant's or Owner's Name in the Alphabetical Order, under which, in the Second Column, may the Parcel be found. The Third ſhews whether it is Free or Copyhold; the Fourth or Fifth, the Quantity in Statute Meaſure, either Free or Copyhold.

The numerical Letter in the Margin on the Left IV. ſhews it is in the Fourth particular Map: f. 6. refers to the Parts of the Map; find f. at the Top, and 6 on the Left Side, and in the Angle of meeting of thoſe Squares is the Houſe, Clete; and ſo for any other.

There is but one Objection I can at preſent foreſee, that can bear any Weight againſt this Method of dividing the general Map, *viz.*

That by dividing the ſame into geometrical Squares, many of the Parcels, Lands and Grounds, will be cut into Two ſeparate Pieces; one Part whereof will lie in one particular Map, and the reſt in another; as in Fig. 4. Map IV. Part of *Calmer* and *Broad-Cloſe* will be in the Vth Map.

In this Caſe, it is uſual to put the Owner's Name, and Quantity, in that which is the greater Part, and in the Terrier refer alſo to the Remainder; where, if the Shape, Lengths, *&c.* are required, they may be diſcovered.

But as this may not be ſatisfactory, or fully anſwer the Objection; the Two following Methods will intirely obviate the Difficulty, and make them as fully ſubſervient to all Purpoſes, as any large and intire Map on one Piece.

1. The firſt Method is, to take juſt ſo much in a particular Map as is circumſcribed by ſome known Roads, Lanes, Brooks, Boundaries of particular Owners or Tenants Lands: This, indeed, will often make the Map very diſproportional, and irregularly ſhaped; but cannot be a material Objection, by reaſon, in Surveys, there is ſeldom any thing regularly ſhaped.

2. The ſecond Method is, to have a wider Margin, or rather draw the particular Maps by a ſmaller Scale, as Four Chains in an Inch, inſtead of Three Chains 20 Lines; and that will allow Room to add the Parts of the Parcels ſo cut off in the Margin, as in Fig. 5. the IVth particular Map varied, where the Whole of *Broadmoor* and *Calmer* is drawn; then in the Vth and IXth particular Map, may the ſmall Parts, which are in the IVth, be drawn in full: Then will they join by indenting or tallying one into another.

## *To reduce a Scale to fit exactly your general Map.*

First ſee what Extent the whole Survey takes on the Chains you laid it down by in the [illegible], i. e. the greateſt Depth and Breadth, as from the Specimen of the general Map it may appear.

| Depth | | | Breadth | |
|---|---|---|---|---|
| On the upper Chain [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |
| | [illegible] | [illegible] | [illegible] | [illegible] |
| | N [illegible] | [illegible] | [illegible] | [illegible] |
| | N [illegible] | [illegible] | [illegible] | [illegible] |
| The Whole | | [illegible] | The Whole | [illegible] |

Then having fixed on the Size of the general Map to be 10,37 Square, I form a Scale of [illegible] per Inch, that may juſt extend the whole Breadth of the 10,37 Inches; by which you may form all the Squares, and Parts of Squares, in Depth and Length, as above; and at Fig. 3. is divided.

The Breadth of the whole Map, by a Scale of [illegible], is 60,62 Inches, which I would reduce into the Compaſs of 10 ¼ and ⅛ = 10,37 Inches.

Divide 60,62 by 10,37, gives [illegible], which multiplied by [illegible], makes the Product 11,84, that is 11 Chains 84 Links in an Inch, the Scale for the general Map.

Thus have I done all I intended, but ſhall obſerve, that ſeveral of theſe Tables have been made, and, as People have fancied, with Alterations and Additions; but all Variations are not really Improvements. The ſetting it horizontally by Spirit— Tubes, may be curious enough: But as the Difference is very inconſiderable and indiſcernible, when it ſtands Two or Three Degrees out of the Level, I ſhall not trouble myſelf or others about it; only further obſerve, that when Grounds are declining much, and very uneven, if the Table ſtands horizontal, unleſs the Sight or Mark on the lower Part is ſo high as its Top makes a Level with the upper Part of the Table, which is ſeldom done, or practicable, I do not ſee why ſuch a Streſs ſhould be laid on the Inſtrument's being level, when neither the View by the Index, nor the Meaſure of the Line, either can be, or is taken horizontally: If the Sight of the Index ſtand nearly perpendicular at every Obſervation, it is more than ſufficient for any Exactneſs requiſite in a Survey.

## II. *A Letter from* Richard Richardſon, *M. D.* F. R. S. *to Sir* Hans Sloane, *Pr.* R. S. *&c. incloſing a Paper from* William Wright, *Surgeon, concerning a large Piece of the* Thigh-bone, *which was taken out, and its Place ſupplied by a* Callus.

*SIR,*

I Take this Opportunity of inquiring after your Health by my Son, who waits upon you with the incloſed, and Part of the *Os Femoris* accompanying it [ſee TAB. I. Fig. 6.]. As the Caſe appeared to me ſomething remarkable, I thought proper to communicate it to you. It was drawn up by Mr. *Wright*, a Surgeon, in *Bradford*, in the Weſt-Riding of this County, who performed the Cure; and a few Days ago, for my Satiſfaction, brought the Perſon hither, who that Day had walked Nine Miles before Noon. I examined the Part where the Bone was taken out, which is on the Inſide of the Thigh, about Four Inches above the Knee: and found the Thigh quite ſtrait, but rather thicker than the other, where the *Callus* ſupplies the Defect of the Bone taken out. He appears to be very well and healthy, and makes no Complaint of any Weakneſs, or Uneaſineſs, in the Part; neither is he in the leaſt lame. He brought the Bone, which I herewith ſend, ſome time ago, and, at my Requeſt, drew up the Caſe: You may make what Uſe of it you pleaſe: I really believe the Contents to be true; and ſhall be glad of all Opportunities of obliging you: If any thing farther occurs to me worth your Notice, you may be ſure I ſhall give you an Account of it. I find a Caſe of this kind in *Ruyſch's Muſeum Anatomicum*, *Pag.* 172. but he gives no Account of the Cure; neither is it ſo extraordinary in itſelf, as it is only Part of the *Os Tibiæ* which is ſeparated: and this which I ſend you, appears to me to be the whole Subſtance of the Bone, except what was eat away before it was taken out.

*Your very humble Servant,*

Bierley, Jan. 16. 1719/20.

Richard Richardſon.

*SIR,*

THIS Bone is Part of the *Os Femoris*, taken out of a young Man's Thigh, *viz.* 20 Years old, about the latter End of *March* 1718. His Name is *Hird Ramſden*, he lives at a Place called *Brathwait*, near *Kighley*. His Lameneſs was occaſioned by a

Fever, which was tranſlated into his Thigh, where it impoſtumated, and was afterwards opened; but, not healing again, left Three or Four carious or fiſtulous Ulcers, which diſcharged a great Quantity of *Sanies*, and fetid Matter. In this Condition he had been Six or Seven Years, before I was concerned for him, and was looked on as incurable; this continual Diſcharge had reduced him almoſt to a Skeleton. I examined his Ulcers with my Probe, and found in one of them, which was on the Inſide of his Thigh, a rotten Bone: I dilated the Orifice with *Gentian* and Sponge Tents, and afterwards I laid it open about Three or Four Inches: I then dreſſed it with *Tincture* of *Myrrh*, and Doſſils of dry Lint; and at every Dreſſing, over the carious Bone the Powder of *Rad. Ariſtot. Myrrh*, and *Euphorb.* in order to promote Exfoliation: With theſe Applications the Bone began to looſen, which looked much larger than I expected. I was afraid of making another Inciſion becauſe of the Crural Artery, which lay very near the Place where the Bone was taken out: I therefore choſe rather to do it gradually by dilating the Orifice, than run the Riſque of another Inciſion. The ſame Dreſſing was continued, and the ſpongy Fleſh kept down with the Powder of *Mercur. præcipit. rub. & Alum. Uſt.* *āā.* At every Dreſſing I raiſed the Bone with a hooked Inſtrument, and in about Four Months time I got it quite out. The Cavity was afterwards kept open for ſome time, with Doſſils of dry Lint, to make way for ſome looſe Pieces that were left behind. The Ulcer, after it was well digeſted, healed up in a little time. During this time his Knee was very much contracted, which was afterwards extended by the Uſe of emollient Fomentations. He now is perfectly ſound, and in a good State of Health, walks ſtrait, and his Thigh is not any ſhorter than the other. This is the true State of the Caſe. I am,

*SIR,*

Bedford, Jan. 15. 17[illegible] *Your humble Servant,*

William Wright.

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## III. *An Account of a monſtrous* Fœtus, *reſembling a hooded* Monkey: *Communicated by Mr.* William Gregory *of* Rocheſter.

A Woman, aged 44, of an athletic Body, conceived with Child a little before *Chriſtmas* 1730. upon which enſued all the uſual Symptoms of Pregnancy. Soon after Conception, ſome Fellows who travel the Country, with a *Bear* and a *Monkey*, placed themſelves before the Woman's Door, in order to make Diverſion for the Populace. The *Monkey* had a Hood on, which reached to his Shoulders, of which the Woman took prodigious Notice; and all the time the *Monkey* was playing his Tricks, in turning over a Stick, *&c.* the Woman could not keep her Eyes off from him. Some ſmall time after, the Woman met a Man of a thin, pale, diſmal Aſpect, upon whom ſhe looked very earneſtly, and thought his Face to be (to a Tittle) like the *Monkey's* Face. When the Woman was quick with Child, and the *Fœtus* began to move, the Woman felt it turn over and over, many times ſucceſſively, juſt as the *Monkey* turned over the Stick; and as often as it moved, it was in the ſame Manner. In the Seventh Month of her Pregnancy, ſhe was taken ill, with a Vomiting, Gripes, and Looſeneſs, which ſoon ceaſed without the Help of Medicine; upon which the Woman's Belly began to grow leſs, and the *Fœtus* did not move ſo often, nor ſo ſtrong, as before. The Woman began to be very uneaſy, thought her Caſe dangerous, and that ſhe was not with Child; upon which ſhe conſulted me. I examined how ſhe was from the Beginning, and found her Caſe as above related: I then gave it as my Opinion, that ſhe was with Child, and begged ſhe would not take any Medicine, until her Time of Reckoning was expired, which (with much Difficulty) I prevailed upon her to conſent to. I was ſent for in a Month after, and was deſired to give her ſomething to bring down her great Belly, ſhe believing herſelf not with Child. I was ſtill of Opinion ſhe was with Child, and told her, that what ſhe felt move in her Belly, was in all Probability a Child; and the Fulneſs of her Breaſts, and other Symptoms, were ſtrong Proofs of her being with Child. I endeavoured to convince her, that there was no Danger in her Caſe, as far as I could apprehend; ſhe being then in tolerable good Health, and able to attend the Affairs of her Family. I again prevailed upon her to deſiſt from taking Medicine for a Month longer: The Month elapſed, and no great Alteration. She felt ſomething move faintly about the Expiration of the Ninth Month, when I viſited her, and was then in tolerable good Health, though very uneaſy at her great Belly: I told her, that ſhe might be miſtaken in her Reckoning, and that ſhe would go a Month longer: She was poſitive ſhe was not miſtaken, for that ſhe had miſſed her *Menſtrua* ſome time before *Chriſtmas*, which ſhe never uſed to miſs, but when with Child; and now ſhe could not believe herſelf with Child, by reaſon her full Time of Pregnancy was expired. I told her the Danger of taking purging Medicines, whilſt ſhe was with Child: and gave her Inſtances in the Neighbourhood, of the fatal Conſequences of ſome Mens Practice in the like Caſe; by which I again prevailed upon her to tarry another Month, at the Expiration of which I gave my Patient a Viſit, and found her much as ſhe was when I ſaw her before. Now Ten *Lunar* Months were elapſed, and my Patient felt nothing move in her Belly for Six Weeks paſt: I then confeſſed I had miſtook her Caſe, but gave her Hopes there was ſtill a Probability of removing her Diſtemper, and reſtoring her to Health; in order to which I immediately ſent her an Infuſion of *Sena, Rhubarb, Sal. Tartar. &c. cum Syr. de Rhamno*, which ſhe did not take for Two Days after, being the 5th of *September* 1731. My Patient took the Potion about Five in the Morning, and before Six ſhe was taken with the moſt exquiſite Travail-pains: A Meſſenger was diſpatched for me, but, before I could come to her Aſſiſtance, ſhe was delivered; the *Fœtus* came, with the *Placenta, Membranes*, and Humours, all whole, which were preſerved until I came, which was ſoon after; and, to my great Surprize, found the *Fœtus* as before-mentioned. I took out my Inciſion-knife, and divided the *Membranes*; ſo took out the *Fœtus*, with the Twiſt in the Navel-ſtring, as it now appears; the *Mem-*

*Membranes* were very ſtrong, but the Humours were very foul, and but ſmall in Quantity, though not fetid. My Patient, who is a Woman of Probity and good Underſtanding, declared, from ſtrong Reaſons, that ſhe conceived at the Time above-mentioned, and was delivered as mentioned before; the Twiſts in the Navel-ſtring are Demonſtration, that the *Fœtus* moved in the *Matrix*, in the manner my Patient deſcribed. The Oddneſs of the Caſe made me more particular in giving a true Hiſtory of it, which, I hope, will be an Excuſe for my Prolixity. I need not here mention the exact Reſemblance of the *Fœtus* to a hooded *Monkey*: The *Fœtus* itſelf will ſhew it more particularly than I can relate it.

I aver the above Caſe to be ſtrictly true, to the beſt of my Knowledge, as witneſs my Hand this 30th Day of *April* 1733.

*From* Rocheſter. William Gregory.

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## IV. *The Caſe of* Mary Howell, *who had a* Needle *run into her* Arm, *and came out at her* Breaſt.

*MARY Howell*, late of *Oſwaldeſtry* in *Shropſhire*, Spinſter, had on the 3d Day of *March* 1732. a ſmall Needle, which ſhe had ſtuck upon the Sleeve of her Gown, by her accidentally running againſt a Door, drove, with ſome Thread twiſted about it, into her Left Arm, about Six Inches below her Shoulder; and a young Woman, (one *Mary Price*) endeavouring to draw out the ſaid Needle, broke off the Eye thereof, and left the Needle in her Arm: Upon which ſhe directly applied to Mr. *Tomkins*, a Surgeon, in the ſame Town, who endeavoured to extract it, but could not, without laying her Arm open, which ſhe would not ſuffer. About a Month after which ſhe felt a gnawing Pain above the Place where the Needle ran in, and up to her Left Shoulder, which laſted her Three or Four Days, and ſo returned by Fits, till at length (about 17 Weeks ago) ſhe felt a gnawing Pain (ſhe thought) at her Stomach, which made her very ſick, and reaching to Vomit, and continued to afflict her (eſpecially in the Mornings) till about the *Sunday* after *Eaſter* laſt; in the Evening of which Day ſhe fancied a Pin was got into her Right Breaſt, in the under Part; and Two Days after applied to Mr. *Robert Nanney*, Surgeon, in *Fetter-lane*, who the ſame Day lanced her ſaid Breaſt, and extracted the ſame Needle, as ſhe verily believes, as having no Eye, but the Thread ſtill twiſted round it.——Which Needle, about an Inch long, without an Eye, and with Thread ſtill twiſted about it, ſhe produced before ſeveral; and ſhe ſaith, that from the Time of the ſaid Needle being ſo drawn forth, ſhe never had any Return of Pain in her Breaſt, Stomach, Shoulder, or Arm.

*London, June* 2. 1739.

V. *Mr.*

## V. *Mr.* Alexander Orme's *pectoral Syrup, ſent in a Letter to Sir* Hans Sloane, *Bar*$^{t.}$ *&c. from* Culcutte, *dated* Jan. 25. 1733.

℞ Nantsjera Patsja *Horti* Malabarici *cum toto q. v. Inciſ. & contuſ. coq. ex aquæ font. q. ſ. Colaturæ fortiter expreſſ. adde Sacchari par pondus, & coque ad Syrupi conſiſtentiam abſque clarificatione.*

### *Some Uſes of the* pectoral Syrup.

A Drop or two, with a little Honey, given to new-born Infants, greatly helps the neceſſary cleanſing of the Bowels. Three or Four Drops are a ſafe Puke for them, and cleanſe the Stomach and Bowels from that Phlegm that cauſes their Gripes.

It is of great Service in moſt Aſthma's, and has relieved, when the beſt Remedies have failed. If the Fit is violent, give a large Spoonful of it, which will ſoon procure a Vomit or two. If the Fit is moderate, Two Tea Spoonfuls three times a Day will be ſufficient.

In Fevers that are attended with a laborious Breathing, it has been found ſerviceable.

It is excellent in the Small-pox, as well to vomit in the Beginning, as to help on the neceſſary Salivation in the confluent Sort.

It helps Coughs, and promotes Expectoration.

From theſe few Hints, a Phyſician will be able to adjuſt its Uſe in other Diſtempers. I ſhould not re-

recommend it, had not repeated Experience convinced me of its Uſefulneſs: And that it may be of Uſe to Poſterity, I mean to Phyſicians that are really ſuch, I gave the Receipt of it to be given to the Preſident and Cenſors of the College of Phyſicians, *London*.

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## VI. *A Letter from the Rev. Mr.* Henry Miles *to Mr.* John Eames, F. R. S. *concerning the* Seed *of* Fern.

*SIR*,

IN the Edition which the celebrated *Boerhaave* and *Gaubius* have given us of *Swammerdam's Biblia Naturæ, ſive Hiſtoria Inſectorum*, in *Dutch* and *Latin*, 2 Vol. in Fol. printed at *Leyden* 1737. and 1738. we have an Epiſtolary Diſſertation on the Seed of the Male *Fern*, together with a very curious Cut, repreſenting the Seed-veſſels, their Mechaniſm, and the Seed, as viewed by a good Microſcope; inſerted at the End of the ſaid Hiſtory. The Cut I have attempted, with my unſkilful Hand, to draw, as well as I could; and, poſſibly, it may help you to conceive of the Form of what it is deſigned to repreſent, in ſome meaſure.

The Author, I find, claims to himſelf the having firſt diſcovered the Seed of *Fern*, in his Diſſertation, at the Beginning: "You rightly judge" (ſays he to his Friend) "me to have been the firſt," *&c.* *Boerhaave* ſays, that he ſhewed them to the Botanic Profeſſor at *Leyden Anno* 1673. and that he had drawn the Figures of them. But I find Dr. *William Cole* ſent an Account of the Seeds of divers of the Plants called *Dorſiferous*, to * Dr. *Robert Hook*, in a Letter dated *September* 30. 1669. and gives a pretty juſt Deſcription of the Seed-veſſels, and the manner in which they grow, and intended a Delineation of the Figures. *Swammerdamm*'s great Piety, which ſhines conſpicuouſly throughout his Work, teaches me in Charity to conclude, he ſpake what he thought to be true; and, poſſibly, he might have made the Diſcovery many Years before the time when he ſhewed the Seeds to the Profeſſor. However, I am humbly confident of this, (after numberleſs Trials made with all kinds of Microſcopes, and in all Poſitions, and with different Lights) that *Swammerdamm's* Account is juſt and accurate, in every Point. I have viewed the ſeveral kinds of *Fern*, *Engliſh Maidenhair*, other ſorts of *Maidenhair*, *Wall-rue*, *Harts-tongue*, and find the Seed-veſſels of the ſame Form in all, ſome little Difference being between ſome of them in the Size only; and in the manner of their being inſerted on the Back of the Leaf, with the Numbers in various Plants, there is a more conſiderable Difference. I obſerve, where you have fewer Seeds, you have more of a ſort of *Fungus*, or Tubercule, very like what is called *Jews-ears*, which ſeems to me deſigned to ſhelter the Seed, which grow, as under Covert, round about them.—In the Female *Fern*, and *Engliſh*

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* Who was the firſt *Engliſhman* that diſcovered the Seed of the *Fern* by the Help of a Microſcope.

*Maidenhair*, the whole Surface of the Leaf on the Inſide ſeems covered, ſo the Seeds guard one another in ſome meaſure, though in theſe I find, after the Seed-veſſels are ſhook off, ſmall Membranes here-and-there on the Surface, a little curled, looking as if they had been raiſed with the Edge of a ſharp Penknife, from the Skin of the Leaf, not altogether unlike the Pieces of Skin we are wont to raiſe in trying a Penknife on one's Hand.

The Plant which I have attempted a Figure of at *B*, TAB. II. with its Seed-veſſels, *&c.* is the *Filix mas Dodonæi*; on the Inſide of the Leaves of which are uſually ſeen ſeveral Spots placed in a regular manner, of a Light-brown or Ruſſet.——In this Plant the principal Part of theſe Spots is the *Fungus* before-mentioned, around which the Seed-veſſels are inſerted.

The Seed-veſſels conſiſt of a Stalk, by which they are inſerted into the Leaf, as *c c*, of a ſpringy ribbed Chord *e e*, having a great Number of annular Ribs, exactly reſembling the annular Cartilages in the *Aſpera Arteria*; and I know nothing in Nature ſo aptly reſembling this Chord, as the *Aſpera Arteria* of a ſmall Bird, as a *Robin* or *Nightingale*, &c. This Chord incircles the globular membranaceous Pod, wherein the Seed lies, adhering to it, and dividing it into Two Hemiſpheres. The Pod *f f* is, in Appearance, compoſed of a fine whitiſh Membrane, ſomewhat like that which lines the Inſide of a Pea-ſhell. The Seeds, *Fig.* 3. *k.* are irregular in Shape, and in the Surface of them, a little reſembling a ſort of Net-work, which I have endeavoured, in my rude Manner, to mimic.

In viewing this admirable Production of Divine Wiſdom in this Plant, I uſe a ſingle *Lens*, and no deep Magnifier, that I may have the Advantage of the Light falling on the Objects. I throw a Quantity of Seed-veſſels on a circular Plate of Ivory; and, if the Plant be newly gathered, (the proper Time is about the Beginning of *September*) I often have the Pleaſure of ſeeing the Seed-veſſels burſt; the Motion of which at that time may be ſeen by a good Eye unaſſiſted. But, when I happened to light of a Pod not thoroughly criſp, I have had the Satisfaction of ſeeing the gradual Procedure of the Burſting of the Veſſel, in order to the ſcattering the Seed, in the following Manner: Firſt, the Chord breaks, and by expanding rends the *Folliculum* or Pod in Two Parts: By going on to expand itſelf, as it departs from a Curve, and approaches to a Right Line, it rends itſelf away from the globular Pod *gradatim*, till it be wholly diſcharged from it; when, as there can be no further Reſiſtance made to the Chord in expanding itſelf, it naturally gives a ſudden Jerk (which in this Caſe is very gentle); and thereby the Seeds are ſhed on the Surface of the Plate, in the ſame manner as if you were to caſt ſome Grains of Corn out of a Bowl on the Plane of a Table-board: This I have ſeveral times ſeen with unſpeakable Pleaſure; but where the Veſſel is more criſp, the Motion of it in burſting wholly eſcapes the Sight, flying away with great Violence beyond the Field which the *Lens* takes in. Sometimes I have obſerved the Pod to be 10, ſometimes 20 Minutes in burſting; in which time you may have a diſtinct View of the Procedure. I would add, that I have more than once ſeen the Pod broke in the Side by ſome Accident, as at *l*; and the Seed lodged within, while the Chord has been whole, and ſtill embraced it.

One might have the Opportunity of ſeeing this curious Piece of Divine Mechaniſm to greater Advantage, if I could find a way to get the Seed-veſſels from the Leaves in a leſs rude manner than by rubbing them; for they will not eaſily be diſcharged from the Leaves, (for I believe they continue a Month after the Seeds are diſperſed) ſo as to collect any Number of them together, and this Method burſts them. When I have been attempting this, they fly about like exceeding fine Vapour or Smoke, and are very troubleſome to one's Hands, *&c.* by getting into the Pores like *Cowidge*.

In the Paper marked *A*, is a Repreſentation of a ſmall Piece of the Leaf of *Harts-tongue* magnified, taken from Dr. *Grew*'s Anatomy, or Hiſtory of Plants, Plate 72. referred to Book IV. Page 200. I was ſurpriſed to ſee that Cut ſo little reſembling the true Figure: Indeed the Doctor ſays it was a cloudy Day when he viewed the Object; and I am ſure he had no juſt Notion at all of the Spring which embraces the Pod, as to its Texture; for it is by no means ſpiral, or like a Screw [I have ſent you a little Bit in a Paper, to be ſubmitted to your Examination]: nor do the Seeds grow in that regular Manner, as repreſented in the Figure.

Whatever Uſe may otherwiſe be made of this Diſcovery, a moral one naturally preſents itſelf to us; *viz.* To admire the infinite Wiſdom and Skill of the Wonderful CREATOR: For what thinking Mind can help being ſtruck with Aſtoniſhment, when he conſiders the *Seed-veſſels* of a coarſe Plant, ſo minute as to fly about in the Air like Vapour, but a little Remove from being inviſible to a naked Eye, framed with ſuch curious Mechaniſm, containing a great Number of Seeds, too fine to be kenn'd by the acuteſt Sight without the help of Glaſſes!

*Your moſt humble Servant,*

Tooting, Oct. 29. 1741

H. Miles.

### *References to* TAB. II.

Fig. 1. A Branch of the Plant.
Fig. 2. The Seed-veſſels.
Fig. 3. The Seeds.
a a. *A Branch of the Male* Fern.
β β. *Refer to the Leaves, on the Back-ſide whereof, the Excreſcencies, like* Jews-ears, *grow, around which grow the Seed veſſels.*
c c. *The Stalks of the Seed-veſſels.*
d. *A Shoot from the Stalk, producing ſometimes another Seed-veſſel on the ſame Stalk.*
e e. *The ſpringy Chord, embracing the Pod, which contains the Seed.*
f f. *The Pod.*
g. *The Pod with a Crack or Chink in it, to repreſent its being about to be divided into Two Hemiſpheres.*
h h. *The Chord expanded, approaching a right Line.*
i i. *The Two Hemiſpheres, when the Pod is divided in two.*
k. *The Seeds.*
l. *Seeds in the Pod, the Membrane being broke and turned up.*

VII. *Ex-*

## VII. *Extract of a Letter from* Joſ. Ignat. de Torres, *M. D. to the* ROYAL SOCIETY, *containing an extraordinary Caſe of the* Heart *of a Child* turned upſide down.

*Gandia* in *Valentia, March* 10. 1738. *N. S.*

—UPON occaſion of mentioning Anatomy, I am in Hopes you will not be diſpleaſed with an Account of a new and ſurpriſing Prodigy concerning the Heart, the like of which was never hitherto obſerved, till I ſaw it on the 29th of *December* 1736. in a new-born Female Infant of the Town of *Almoyna*, and faithfully delineated it. Innumerable *Phænomena* have been obſerved in the human Heart, ſome few of which I ſhall mention.

*Ballonius* ſaw a Heart ſo large, that its monſtrous Size alone, without any Defect in the Lungs, occaſioned an *Aſthma*.

*Bartholinus* found *Caruncles* in the *Ventricles*.

*Spilembergerus* obſerved a ſmall Bone therein, which occaſioned a *Phthiſis*.

*Zacutus Luſitanus* tells us from the Report of another Perſon, that a * Worm was found in the Left Ventricle, which brought on dreadful Symptoms. Its Head was yellow, its Body white, and its Tail ſplit.

*Riolanus* opened the Body of a Man, whoſe Heart was cartilaginous.

According to *Raygerus*, the *Aorta* with the *Valves* was found oſſified; which was the Cauſe of ſudden Death. Ge-

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* Rather a *Polypus*. C. M.

*Geneſius* of *Valencia*, a very able Phyſician, has appriſed me in one of his Letters, that, upon opening his young Son, he found the Heart inverted; that is, the Left Ventricle on the Right, and the Right on the Left Side.

*Amoroſius* ſaw a Heart with Two Points, which on the Outſide ſhewed the Two Ventricles.

*Sirenarius* found a Heart with its Cone in the Right Side, and there the Pulſation was conſtantly felt.

*Martinezius*, Firſt Phyſician to the King of *Spain*, obſerved in a new-born Male Infant, the Heart puſhed out of the Breaſt, with its Cone and Baſis lying horizontal, and without a *Pericardium*: A new and remarkable *Phænomenon*; as if the Heart, not bearing ſo cloſe a Confinement, burſt through the Breaſt, and, having broke the *Sternum*, appeared on the Outſide.

I omit *Benivenus*, *Muretus*, *Scultetus*, and *Gierſdorf*, who obſerved the Heart hairy, and found Stones, *Polypuſes* and *Abſceſſes* in its Ventricles.

In fine, I have obſerved, in a new-born Female Infant, the Heart without a *Pericardium*, and turned upſide down, ſo that its Baſis, with all the Veſſels, had fallen down as low as the Navel; and its *Apex*, ſtill on the Left Side, lay hid between the Two Lungs. It would be a great Pleaſure to me, to tranſmit this uncommon Obſervation to Poſterity in a proper Light. But as it will require a Diſcourſe too large for a Letter, and am apprehenſive of being tedious, at preſent I only ſend you this Notice of it; but promiſe that as ſoon as I have finiſhed a Diſſertation thereon, which I have already begun, I will ſend it to the ROYAL SOCIETY, with a Figure of the Infant, with the Parts in their proper *Site*. One thing I cannot paſs in Silence, *viz.* how the Circulation could be carried on, the Heart being thus inverted: and yet the Child lived ſeveral Days after Birth. I obſerved the Heart from its Baſis, whence the *Aorta* and pulmonary Artery ſpring, and where the *Cava* and pulmonary Vein enter it, to its Cone, ſurrounded looſely with ſeveral Windings of theſe Veſſels, through which the Blood's Circulation muſt neceſſarily be performed. A wonderful Sagacity in Nature! but I ſhall reſerve the reſt for my Tract.

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## VIII. Johannes Caſtillioneus $D^{no}$ *de* Montagny, *V. D. Philoſoph. Prof. in Acad.* Lauzanneſi, *Reg. Soc.* Lond. *Soc. &c. de Curva* Cardioïde, *de Figura ſua ſic dicta.*

S. P.

NON ignoro, V. C. novarum curvarum inveſtigationem, tanquam nimis Analyſis facilem, contemni: Cum tamen D. *Carre*, non mediocris Geometra Regiæ Scientiarum Academiæ, (28 Feb. 1705.) novam curvam, quanquam *vix ſumma ſequens faſtigia rerum*, proponere non dubitârit; cur tibi, viro in amicos benigniſſimo, nonnulla, quæ mihi ejuſdem *Carre* diſſertationem legenti venerunt in mentem, ſcribere non auſim? Sed proœmiis omiſſis, ad rem.

Semicirculi *B M A*, (Fig. 1. 2. 3. TAB. III.) diameter *BA*, ita, puncto *B* peripheriam radens, ut ſemper

tranſeat per punctum $A$ gignet curvam, de qua agitur.

Ex generatione patet,

1°. Quod $DA\alpha$ normalis ad $AB$, æquat diametri duplum.

2°. Quod hujus curvæ peripheria $ADNa\alpha NA$ ſiniet in $A$.

Curvam hanc a figura *Cardioïdem*, ſi placet, appellabimus.

Jam per $a$, & $A$ ducantur $aE$, $AQ$ normales ad $aA$, & ubi libet $EN$ normalis ad $aE$: Ex geneſi erit $AN = BA \pm AM$, & (per ſimilitudinem triangulorum $QAN$, $MBA$) $AQ = BM \pm MP$, ac $NQ = MA \pm AP$.

Hæc eſt præcipua hujus curvæ proprietas, altera non injucunda eſt, quod recta $NN$ ſemper æquat diametri duplum, & ſemper a circulo biſecatur in $M$.

Sit nunc $BA = a$, $aE = x$; $EN = y$, Erunt $QN = \pm y \pm 2a$, $AN = \sqrt{x^2 + y^2 - 4ay + 4a^2}$, & $MA = \mp a \pm \sqrt{x^2 + y^2 - 4ay + 4a^2}$; quæ quatuor lineæ per analogiam comparatæ, dant æquationem ad curvam.

$$y^4 - 6ay^3 \left.\begin{matrix} + 2x^2y^2 - 6ax^2y + x^4 \\ + 12a^2y^2 - 8a^3y + 3a^2x^2 \end{matrix}\right\} = 0$$

Curvæ ſubtangens juxta vulgatas methodos, eſt

$$\frac{2y^4 - 9ay^3 + 2x^2y^2 + 12a^2y^2 - 3ax^2y - 4ay^3}{6axy - 2xy^2 - 3a^2x - 2x^3} = \frac{\dot{x}}{\dot{y}}$$

Sed ex curvæ generatione facilior ducendæ tangentis ratio deduci poteſt. Veniat $MAN$ in locum primo quamproximum $mAn$, ſumantur $AR = AM$, & $Ar = AN$, & junctis $MR$, $Nr$, ducatur per $A$ recta

$AT$ iis parallela, & per $Mm$, $Nn$, rectæ $MT$, $nt$. Jam $nA : At :: nr$ (vel $mR$) $: rN :: mR \times MA : rN \times AM :: mR \times MA : MR \times AN :: MA \times Am : AN \times AT$, ſed in ultima ratione $mA = MA$, & $TA$ normalis ad $MN$, quare $nA : At :: MA^2 : AN \times AT$; ſi nunc ex $M$ ducatur per circuli centrum $F$, recta $MF$ producenda, donec rectæ $TA$ item productæ occurrat in $G$, id eſt, uſque ad circuli peripheriam, erit $MA^2 = TA \times AG$; quapropter $nA : At :: AG : AN$; deſcribatur igitur ſemicirculus per $G$, & $N$, qui ſecabit rectam $AT$ in $t$, ex quo ducta recta $tN$ erit tangens ad curvam, ad quam inſuper recta $NG$ eſt normalis; hinc jungantur $MO$, cui ex $N$ ducatur parallela, quæ tanget curvam.

Hic obiter notandum puto hanc ducendarum tangentium methodum probe convenire pluribus curvis.

Sit $AB$, Fig. 2. Conchois Nicomedæa: Tūc (ſuppoſita ſuperiori præparatione) $BP : Pt :: BR$, (vel $cr$)$: Rb :: cr \times CP : Rb \times CP$, (vel $rC \times PR$) $:: \overline{CP}^2 : TP \times PR$, unde deducitur ſuperior conſtructio.

Recta longitudinis datæ Fig. 3. $CPB$, extremitate $C$ radens rectam $CDT$ ad $DA$ normalem, ſemper tranſeat per punctum $P$ datum in ipſa $DA$, & ita curvam $AB$ gignat.

Superiorem præparationem, & ratiocinium huic aptans habebis $BP : Pt :: bR$ $(rc)$ $: RB :: cr \times CP : RB \times CP$ $(BP \times rC)$ $:: CP^2 : BP \times PT$, ut ſupra. Piget plura referre.

Cæterum methodus de *maximis*, & *minimis* dat maximam ordinatam $= \frac{3a}{4}$, & ejus abſciſſam $= \frac{a}{4}\sqrt{3}$. Poſſet eodem pacto inveſtigari abſciſſarum maxima;

ſed *longæ ambages*, *ſeries ſed longa* laborum; quare ſic eam quærito.

Quia $EN$, Fig. 1. eſt tangens ad curvam, recta $MG$ ex puncto $M$ per centrum $F$ ducta determinat punctum $G$, ex quo ducta $GN$ eſt normalis ad $EN$, ergo & ad $Aa$, ex hypotheſi, ſed $NQ = AV = MA + AP$; ergo $VP = MA$; atqui $BA : AM :: MA : AP$; ergo $BA : PV :: VP : PA$; ſed $PF = FV = a - 2z$; & ideo $a : a - 2z :: a - 2z : z$. Unde facile deducitur $z = \frac{a}{4}$, $EN = \frac{7a}{4}$, $AQ = \frac{3a}{4}\sqrt{3}$. Ubi notandum quod idem punctum $M$, quod præbet in recta $NAMN$ punctum majoris ordinatæ, præbet etiam punctum majoris abſciſſæ.

Sed jam ſatis patientia tua abuſus videor: quare finem faciam, nonnulla alia, quæ de hac curva commentatus ſum, propediem miſſurus, ſi putes hæc & ſimilia non indigna, quæ a te ſubciſivis horis legantur. Vale,

Vir, *quo neque candidiorem*
*Terra tulit, neque cui me ſit devinctior alter.*
Viviaci, pridie Kalendas Apriles 1741.

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## IX. *Ad Eclipſes Terræ repræſentandas, Machina* J. And. Segneri, *Med. Phyſic. & Mathem. Prof.* Goetting, R. S. S.

UT eclipſis aliqua terræ oculis exhibeatur ſpectanda, projectio arcuum & circulorum, qui in hemiſphærio terræ illuminato concipiuntur, in planum, ſervire poteſt egregie: Sique in ejuſmodi projectionem loca etiam inſerantur in ſuperficie terræ ſita, urbes puta, littora, inſulæ, reliqua, addaturque circulus, penumbræ lunaris poſitum atque magnitudinem exprimens, eique concentrici minores aliquot, uno obtutu luſtranda depinguntur loca terræ, quibus eo tempore plane tegitur Sol a Luna, & quibus quælibet ejus pars viſui ſubducitur.

Verum momentanea eſt ejuſmodi imago, cumque ea, quæ aliquo temporis articulo adparent, eo verbi gratia, quo centrum penumbræ lunaris diſcum terræ primum ingreditur, cum magna adcuratione ſiſtat; phænomena reliqua, prout partim a rotatione terræ, partim a motu lunæ, pendent, exhibere non poteſt: ut illi, qui omnes omnino eclipſeos adparentias, quemadmodum ſeſe ordine excipiunt, exhibere hoc modo vellet, plurimæ projectiones delineandæ forent; quæ res maximi laboris eſt, quemque ſperata ex eo voluptas compenſare vix poteſt.

Rotata terra iidem quidem manent latitudinum circuli, eademque adeo horum projectio, ſed meridiani, ſive circuli longitudinum, mutantur aſſiduo, horumque projectio, & ſitus locorum terræ, quatenus ab his pendet. Quæ conſiderata, cum aliqua laboris compendia offerre queant, tum, quantum ejus relinquatur, clare docere.

Sed globus terreſtris artificialis hemiſphærium terræ, a ſole quovis tempore illuminatum, minimo labore exhibet. Elevato enim polo ſupra horizontem, vel infra eum depreſſo, ſic, ut ea elevatio vel depreſſio ſit declinationi ſolis, ad datum illud tempus, æqualis; vel, quod eodem redit, collocato loco ſolis in ecliptica globi in ejus Zenith; horizon artificialis finitor ſit lucis & umbræ, qui nempe hemiſphærium terræ illuminatum ab obſcuro diſtinguit, nihilque ſupereſt, quo hemiſphærium illuminatum plane exhibeatur, quam, ut circa axem ſuum rotetur globus, donec eum obtinuerit ſitum, quem hora diei requirit.

Atque ita, quod in projectionibus difficillimum eſt, per globum facillime perficitur, naturæque etiam, quam per illas, convenientius. Quod cum penſitarem, illud verum ſupereſſe vidi, quo per globum eclipſeos terræ cujuſvis omnia phænomena exhibeantur, uti penumbra lunaris in eum projiceretur, utque machina fieret, qua ejus ſitus ad quodlibet tempus repræſentari, eaque ad loca terræ in globo deſignata referri poſſit. Qua rei facilitate illectus ſum, ut de ejuſmodi machinamento cogitarem: idque eum in modum, quem figura adjecta Tab. III. Fig. 4. exprimit, efficere ſum conatus.

Ea globum terreſtrem ſiſtit, vulgarem, horizonte ſuo atque meridiano, circulum gerente horarium, inſtructum. Horizonti connexa ſunt duo brachia lignea, *AB*, *ab*, Fig. 4. Tab. III. ejus longitudinis, quæ paullulum excedit ſemidiametrum globi. Eorum brachiorum extremitates alteræ, *ACD*, *ac*, ita factæ ſunt, ut comprehendere horizontem poſſint, & cochleis, quarum una apud *D* comparet, ad quodlibet ejus punctum firmari.

Oppoſitis vero brachiorum extremis, *B*, *b*, fulcra inſiſtunt, lignea pariter, horizonti perpendicularia, *BE*, *be*, ejus altitudinis, quæ ſemidiametro globi, cum latitudine meridiani ænei, æqualis ſit, ſic, ut ducta per ſumma fulcrorum linea recta, meridianum contingere nequeat.

Teguntur fulcra orbiculis æneis, quos axes perforant ferrei, utrinque prominentes, & firmiter cum orbiculis juncti. Eorum axium partes inferiores, fulcris, ſecundum horum longitudinem inſerti, firmantur: quare & orbiculi, ſitu cum horizonte globi parallelo, redduntur immobiles.

Superiores axium partes teretes ſunt, & pariter atque orbiculorum ſuperficies ſuperiores, politæ: excipiunt autem trochleas æneas *EFG*, *efg*, orbiculis impoſitas, ſic ut motæ utcunque circa axes, plano horizontis parallelæ ſint. Diametri trochlearum ſunt trium fere pollicum, & peripheriæ crenam quæque ſuam habent, excipiendo filo ſervituram. Paullo minor eſt trochlea *efg*. altera *EFG*; nihil enim ex diverſitate iſta magnitudinis machina detrimenti capit: præterea vero nihil habet ſingulare; itaque orbiculo tantum ad *h* oppoſito, ne axe excidat, firmatur.

Verum altera trochlea, *EFG* circulum inſcriptum habet, in ſuos gradus diviſum, quod ob compendium laboris factum eſt, cum in partes quocunque numero alio, dummodo ſatis minutæ eſſent, eodem effectu potuiſſet ſecari; adpoſituſque eſt indiculus *H*, numerum earum partium oſtenſurus: qui quidem ita cum axe cohæret, ut moveri circa eum, cum aliqua difficultate, poſſit; ſed ſic tamen, ut nec indicis motus motum trochleæ afficiat, nec viciſſim, trochlea mota, index e loco ſuo deturbetur. Itaque inter trochleam & indicem orbiculus minutus immobilis interpoſitus eſt, & index ad axem ita firmatus, ut elatere quoquo verſus immobilem eum orbiculum prematur.

Tres deinde radii ænei, *ik*, *il*, *im*, in *i* connexi, habentur, æquales angulos, *kil*, *lim*, *mik* comprehendentes; locus autem *i* foramine minimo pertuſus eſt. Elaſtici ſunt radii, & quantum per firmitatem fieri potuit, tenues, longitudine vero *ik*, ſive *il*, aut *im*, ea quæ quartæ parti diametri globi proxime æqualis eſt. Et hoc penumbræ ferendæ quaſi ſceleton reliquis ſic adplicatum eſt. Porro radii foraminula habent apud *l* & *m*, per quæ traductum filum trochleis circumpoſitum eſt ſecundum *mEFGgfel*, extremis inter *l* & *m* firmiter colligatis: quare ſceleton quoque ad partem fili *elmE* redditur immobile, radio ejus tertio *ik* parti fili *gG* libere incumbente: itaque efficitur, ut, rotata trochlea *EFG* vel *efg*, ſceleton ultro citrove, ſecundum lineam rectam, moveatur.

Explorari his ita conſtructis potuit, quot partes diviſionis trochleæ *EFG* reſponderent globi diametro, hunc in modum. Brachia *AB*, *ab*, collocata ſunt ita, ut, moto ſceleto, centrum ejus *i* diametrum globi percurreret; idque ut effici poſſet, horizonte globi, ſitu cum horizonte terræ parallelo, collocato, demiſſum ex eo centro eſt pendulum *in*, puncta horizontis oſtenſurum, quibus centrum immineret. Itaque, promoto centro ſecundum totam diametri globi longitudinem notari potuit numerus partium trochleæ *EFG*, quæ per indicem *H* interea tranſierunt; qui ſollicite obſervatus, memoria retinendus fuit, cum ejus uſus, ut & reliquorum omnium quæ adhuc deſcripta ſunt, in omnibus eclipſibus repræſentandis, recurrat. Quæ ſequentur, mutari, pro qualibet eclipſi ſingulari, debent.

Eorum autem primarium eſt, diſcus penumbrarum, quem ita efficere conatus ſum. Reperta ex tabulis, ad eclipſim, quam exhibere volebam, penumbræ lunaris in diſco terræ ſemidiametro, ut & parallaxi lunæ horizontali, ſic ſum argumentatus: ut parallaxis lunæ horizontalis, ad radium diſci penumbroſi; ſic ſemidiameter globi terreſtris quo utebar, ad quartum, qui radium exprimebat penumbræ, quam globi magnitudo requireret.

Diviſo eo radio, habita etiam prout convenit ipſius umbræ ratione, in ſex partes, (nam in duodecim dividere modulus machinæ prohibere videbatur) circulos deſcripſi concentricos in charta ſpiſſiore, & ſecundum eos chartam in armillas diſſecui. Harum maximam ſceleto *klm* ita adglutinavi, ut centrum armillæ centro ſceleti *i* congrueret, alteram ab hac rejeci, tertiam ſceleto adglutinavi eodem modo, rejecta quarta, pariterque quintam, rejecto circello intimo; ſic ut figura oriretur, qualis inter *klm* picta eſt, ejus uſus, ut omnibus ſecundum ea, quæ dicenda reſtant, compoſitis, loca in globo deſignata, quæcunque perpendiculariter ſubjecta ſunt exteriori maximæ armillæ margini, initium videre eclipſeos vel finem, oſtenderet; quæ ſub margine ejuſdem armillæ interiori ſita ſunt, eclipſim cernere duorum digitorum, quæ ſub margine exteriori armillæ ſecundæ, eclipſim habere quatuor digitorum, & ita porro; quæ vero ſub centro poſita ſunt, totius ſolis deliquium pati: Nam umbram, propter parvitatem, per ipſum centrum deſignâſſe, ſatis habui.

Componuntur autem omnia pro quolibet eclipſeos datæ momento, hunc in modum. Repertis calculo punctis finitoris lucis & umbræ, quibus centrum lunæ diſcum terræ primum ingreditur, ex eoque iterum exit, hæc notantur in horizonte globi, & brachia *AB*, *ab*, (Fig. 4. Tab. III.) collocantur, ſic, ut, revoluta trochlea *EFG*, centrum *i* diſci penumbræ *klm* ſuper illa tranſeat, quod an fiat, pendulum *in* oſtendit. Tempus deinde reperio, quo centrum penumbræ in loco aliquo verſatur notabili, ut, quo diſcum terræ primum ingreditur, globumque, meridiani atque æquatoris, ſine circuli horarii ope, ita colloco, ut hemiſphærium terræ a ſole eo tempore illuminatum, ejus pars ſupra horizontem eminens, exhibeat. Trochleam autem *EFG* revolvo, donec centrum penumbræ *i* notabili illi loco, ut in noſtro exemplo finitori lucis & umbræ, ad perpendiculum ſit impoſitum; quem ejus ſitum voco primarium, eoque obtento indicem *H* trochleæ, initio diviſionis admoveo. Sic rite ad hoc tempus compoſita habentur omnia, poſſuntque ejus phænomena colligi.

Jam, ex tabulis excerpto motu lunæ a ſole horario, infero, uti parallaxis lunæ horizontalis ad motum hunc lunæ horarium; ſic numerus partium trochleæ *EFG*, qui reſpondet ſemidiametro globi, ſupra repertus, ad quartum, qui indicat, quot partes, trochlea revoluta, per locum indicis traducendæ ſint, ut habeatur ſitus diſci penumbræ, una hora ante vel poſt tempus, quod primario ſitui reſpondet. Collocato ergo diſco in hunc locum, rotatoque circa axem globo, uti par eſt, hujus temporis phænomena haberi pariter poſſunt.

Reliquorum jam temporum ſitus obtinentur facile. Diviſo enim numero partium trochleæ proxime reperto, qui nempe motui horario reſpondet, ut habeatur motus ſemihorii, quadrantis horæ atque minuti horarii, tabula conſtrui ſola additione atque ſubtractione poteſt, in qua, notatis temporibus partes appoſitæ ſunt trochleæ quibus diſcus penumbrarum moveri antrorſum retrorſumve debet, ut ſitum accipiat, qui illi tempori convenit. Qua perfecta nihil opus eſt, quam ut globus ſecundum tempus rotetur, trochlea vero ſic, ut index ejus numerum tempori adſcriptum oſtendat. Prius illud, ſi motus circuli horarii concedatur, imprimis expedite, fit, ſi horæ ordine retrogrado adſcribantur, utpote motui terræ circa axem ſuum accommodato, qui & in figura expreſſus eſt.

Loca tandem in ſuperficie globi deſignata diſco penumbræ in quovis ejus ſitu perpendiculariter ſubjecta, pendulo explorari poſſunt. Sed uno intuitu luſtrantur, toto adparatu radiis ſolaribus, ſi commodum viſum fuerit, a ſpeculo plano reflexis, ita expoſito, ut hi ad horizontem globi perpendiculares incidant. Hoc enim facto a diſco penumbrarum in globum umbræ projicientur, earum æmulæ penumbrarum, quas luna in terram projicit, ex quibus phaſes eclipſis, cujuſvis loci, qui illis involvitur, perſpici poſſunt.

Incommodus hic eſt motus ſolis; ei, qui vitro uſtorio majori inſtructus eſt, lampadem fortaſſe non inepte ſubſtituet, cujus radii a vitro in globum, ejus horizonti normales, projiciantur. Cogitavi quoque de globo eminus per tubum opticum ſpectando, qua methodo ipſe diſcus *klm* in globi ſuperficiem relatus, penumbram exhibet. Verum ad id teleſcopio amplioris campi opus eſt: remoto enim adeo globo, ut totus conſpici per teleſcopium minoris campi poſſit, verendum eſt, ut loca in eo deſignata viſu diſtingui nequeant.

Cogitavi de motu machinæ conciliando, mediantibus duobus horologiis prorſus a ſe invicem ſeparatis, quorum alterum globum converteret, alterum trochleam: quæque ut legitime conſpirarent, per pendula efficeretur. Verum magis mihi convenire videtur, ut veniam eorum, quæ fortaſſe perperam dicta ſunt, ſubmiſſe petam, quam ut iis jam plura addam.

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## X. Samuelis Chriſtiani Hollmanni, *Logic. & Metaph. in nova* Gottingenſi *Academia, P. P. O. Obſervatio de* Sceletorum, *ex* Foliis *virentibus paratorum, quorumcunque* Duplicatura.

EX quo illa *foliorum*, uti vocant *ſceleta*, quæ, quantum conſtat, a celeberr. RUYSCHIO, magno illo verioris corporum ſtructuræ indagatore, primum omnium elaborata ſunt, primum etiam vidi; vidi autem apud virum, quem honoris cauſa hic nomino, celeb. ABRAHAMUM VATERUM, *Anatomiæ & Botanices profeſſorem in academia Vitembergenſi* meritiſſimum; neſcio quæ & admiratio ejus rei, & cupido modum, quo illa præparentur, inveſtigandi, me inceſſerit, quod admirabilis illa, vereque ſtupenda, quæ in foliis ejuſmodi, ut loqui ita fas ſit, excarnatis deprehenditur fabrica tot præclara ſapientiſſimi potentiſſimique Conditoris veſtigia, unico quaſi obtutu conſpicienda nobis præbet, ut dolendum fere ſit vel unicum ex infinito fere illo diverſiſſimorum foliorum genere numeroque debere prius perire, certaque putrefactione in terræ ſinum recondi, quam admirabilem iſtam ſuam fibrillarum minimarum ſtructuram hominum oculis contuendam ſubjecerit. Multa propterea, iterataque induſtria, pro eo, quo in contemplandas res naturales feror, ardore, pericula feci, quibus ſcelera illa parari, maximumque Conditoris ſapientiſſimi in illorum conſtructione latens artificium, *nudum* quaſi, atque ex involucris ſuis in lucem protractum, conſpiciendum præberi aliis poſſet. Eram quoque jam in eo, ut, quod mihi in excarnando aliquo *pulmonum*, cera injecto lobo feliciter jam brevi anteceſſerat, poſt alia fruſtra, nulloque ſucceſſu, inſtituta tentamina, etiam hic *fermentationis* & *putrefactionis* lentæ vim experirer; feliciterque jam quodammodo negotium ſucceſſerat, quum ex *eodem doctiſſimo*, mihique amiciſſimo, *viro* perciperem, & putrefactione omnino id perfici debere, & totum, quo fieri idem feliciter poſſet, proceſſum in *commercio liter. phyſico-medico* quod *Norimbergæ* vulgatur, deſcriptum extare, ubi eundem etiam *a*. 1732. *hebdomad*. 4. *p*. 73. & *hebdom*. 34. *p*. 267. *ſq*. expoſitum poſtea deprehendi. Eo ergo ſecurior jam de methodo, qua uti cœperam, factus, ulterius, non infelici ſucceſſu, ſum progreſſus: præparavi ex variis foliorum generibus *ſceleta* non ſolum, ſed & *cuticulam utramque* folio cuicunque utrinque arctiſſime inhærentem; & ſeparavi facile, & feliciter etiam, qua omnes ſuas dimenſiones explicatam, exſiccavi. Nihil tamen his omnibus hactenus feceram, quin obſervatum jam deſcriptumque, locis modo excitatis, idem extaret. Brevi vero poſt aliquid ex improviſo mihi accidit, de quo mihi nondum conſtat, num a quoquam, ante me, alio in foliorum anatome jam obſervatum unquam ſit. Etenim dum in folii alicujus præparatione occupor, reſque illa minus mihi ex voto ſuccedit, folium iſthoc, in partes varias diſcerptum, laceratumque, impatientia abreptus, in vas, proxime adſtans, impuritatibuſque recipiendis deſtinatum, abjicio, atque ad alia quædam præparanda jam convertor. Subiit me tamen, neſcio qua de cauſa, mox cupido, partes folii iſtius dilacerati quaſdam microſcopio ſubjiciendi, quidve in iiſdem deprehenderem, attendendi. Neque vanus ille labor fuit. Non ſine inſigni enim admiratione mea deprehendi, violenta illa tenerrimarum fibrillarum laceratione partes, arctiſſime ſibi alias impoſitas, jam a ſe invicem divulſas, ſeorſumque diſtinctiſſime conſpiciendas, ſiſti, ſicque per *univerſum* folii iſtius lacerati *ambitum* aliquam *fibrillarum* quarumcunque, majorum minorumque, *duplicaturam* obſervari. Hæſitabam initio, annon violenta iſthac laceratione effectum, productumque aliquid in illa folii parte eſſet, quod naturali ejuſdem conſtitutioni repugnaret, illaque adeo fibrillarum quarumcunque duplicatura adhibitæ potius vis, quam ipſius naturæ opus eſſet: brevi tamen poſthæc dubitatio iſthæc omnis expiravit. Poſtquam in aliis enim, quæ ad manus adhuc erant, foliorum ſceletis, nondum exſiccatis, tentaveram, annon fibræ illæ quibus conſtabant, tenuiſſimæ ſeparari ſe ſine magna vi ſinerent; deprehendi, in foliis, ad *illum* putrefactionis *gradum* jam perductis, ut utraque cuticula nullibi, quam in extremo folii margine, ipſi folio amplius adhæreſceret, poſt ejuſque adeo ſeparationem materia illa folii viridis, ſub eadem latens, putrefactione jam reſoluta, ſponte efflueret, *pediculum* quoque, ſua non minus ſponte, in *duas partes* ſecedere, & detracta cuticula, quæ & ipſi incumbit, quaſi jam hiare, quarum utraque ſi ſeorſim digitis leniter comprehendatur, alteraque ab altera ſenſim paulatimque divellatur, *peculiare* quoddam, atque *ſeparatum*, fibrillarum ſubtiliſſimarum *reticulum* cuilibet illarum annexum eſſe, quod facillime ab altero ſecedit, cujuſque ſingulæ divaricationes, & quaſi ramificationes fibrillarum, *alterius* reticuli divaricationibus adeo exacte *reſpondent*, iiſdemque adeo arctiſſime adjacent, ut *unicum* quoddam reticulum quoque, ante ſeparationem ſuam, propterea modo efficere videantur. Poſtquam hoc ergo in quamplurimis jam hoc modo feliciter ſucceſſerat; obſervavi porro, in aliis, in ſceleta mera jam redactis, & poſt illud tamen tempus, ad facilitandam illam reticulorum minimorum a ſe invicem ſeparationem aqua aliquamdiu adhuc maceratis foliis, imprimis vero in *extremis* illorum *apicibus*, reticula illa *ſua ſponte* jam pauliſper a ſe invicem recedere, alterumque illorum ab altero, quando in aqua limpidiſſima leniter hinc inde agitantur, reipſa *jam ſeparatum* eſſe, manifeſtiſſime deprehendi. Sceleton ergo ejuſmodi alterius manus digito quodam ſub aquam demerſum, fundoque vaſis affixum, tenui; altera interea temporis manu mediante ſcalpelli cuſpide, ſuperius reticulorum iſtorum, ſponte a ſe invicem recedentium, elevare tentavi, donec comprehendi illud leniter digitis poſſet; tumque alterum inferius alio quodam digito ad fundum vaſis deprimere, ibique quaſi affixum tenere, ſicque alterum reticulorum ab altero, facto ab *apice* folii initio, leniter divellere laboravi; quod etiam non minus tandem feliciter ſucceſſit, eademque & hic ſingularum divaricationum & ramificationum utriuſque reticuli exacte ſibi mutuo reſpondentium, diſtributio mihi obſervata eſt.

Quum hac igitur ratione reticula iſta diverſa, in quovis ſceleto præſentia ſua ſponte ita a ſe invicem recedere, plus ſimplici vice deprehendiſſem; non dubitavi amplius, neu *vis*, quam antea adhibueram, aut *artis*, ſed *naturæ* potius, opus illam tenuiſſimarum quarumcumque fibrillarum in quovis folii ſceleto *duplicaturam* eſſe; ſicque, quodvis ejuſmodi ſceleton duplici iſtiuſmodi fibrillarum reticulo naturaliter conſtare, ſatis jam ſuperque convictus fui. Magis tamen iſthac in ſententia poſtea confirmatus adhuc ſum, poſtquam microſcopio obſervavi, *ſingulas* in *alterutro* folii hujuſmodi duplicati reticulo majores, minoreſque, fibrillarum divaricationes incilium alveorumque inſtar *excavatas*; in *altero* vero, contra, ſemper tali *convexitate* donatas, eaſdem eſſe, ut harum *convexitates* illarum *concavitatibus* quam accuratiſſime reſpondeant, hæque adeo illorum ſinu ita excipiantur, includanturque, ut quamdiu ſic inter ſe cohærent, ſimplicem quandam fibrillam referant, nullaque in iiſdem duplicaturæ cujuſdam veſtigia appareant. Adeo manifeſtæ vero hæ convexitatibus ſuis reſpondentes concavitates in foliis, ita præparatis, ſunt, ut in foliis, quæ hic adjeci, duplicatis vel mediocris bonitatis microſcopio facile obſervari a quolibet, qui ad iſthæc modo attendat, poſſint. Neque difficile etiam cuiquam erit, ipſum in hac foliorum diviſione id experiri, quod deſcriptum hactenus a me eſt, modo ſceleta ipſa præparandi artem prius rite tenuerit, ipſeque jam periculum ejus rei fecerit; deinde vero & folia ad juſtum putrefactionis gradum, ſupra jam a nobis indicatum, pervenire permiſerit, totamque operationem in vaſculo, non ultra *ſex* vel *octo* circiter *lineas* profundo, & aqua limpidiſſima repleto, ſuſceperit: tum enim ex voto facile omnia ſuccedere obſervabit.

Foliorum, quæ hic adjeci, *primum* ſub *A*, in TAB. IV. nudum ſiſtit ſceleton more, ſupra indicato, a me præparatum,

ratum, in quo *nulla diviſio* tentata eſt. Alterum, ſub *B*, *diviſum* magna ſui parte fuit; poſt diviſionem vero alterum reticulorum alteri ita iterum ſuperimpoſitum aquæ, in qua tum natavit, adminiculo, eſt, ut pediculi partes data opera ad latus oppoſitum paululum utrinque inclinarentur, quo ſic divaricationes ſingulæ utriuſque reticuli eo melius poſſent conſpici, ſicque totum poſtea ſceleton iſtud exſiccatum eſt. Hoc ipſo vero jam diſtinctiſſime apparet, *ſingulis* unius reticuli *divaricationibus*, majoribus minoribuſque *totidem*, *eodemque ordine*, in altero reticulo *alias* majores, minoreſque, ſemper *reſpondere*, neque ullam illarum ſuo quaſi comite deſtitui.

***Tertium***, quod ſub *C* adjectum eſt, folii ſceleton, methodo hactenus deſcripta, a *caule*, vel *pediculo*, verſus *apicem* folii pergendo, ita diviſum eſt, ut alterum reticulorum ab altero, quouſque ſeparata illa fuerunt etiamnum actu ipſo elevari, & dimoveri, poſſit, reliquis utriuſque reticuli partibus arctiſſime adhuc inter ſe cohærentibus, unicumque ſimplex reticulum modo repræſentantibus, quo ipſo duplicatura iſta ad oculum demonſtrari cuivis poteſt.

***Quartum***, quod ſub *D* deprehenditur, ſceleton eodem modo, ſed ab *apice* ad *caulem*, vel *pediculum* folii progrediendo, diviſum ita eſt, ut altera lamella dimoveri adhuc ab altera poſſit: partes vero pediculo propinquiores iterum ſine ſeparatione omni ſibi mutuo cohærentes relictæ ſint.

***Quintum***, quod ſub *E* adjectum folium eſt, qua *alterum* ſuum *latus*, pediculo adjacens, diviſum modo eſt, unde & hic elevari modo alterum reticulum ab altero poteſt; alterum vero ejuſdem latus in ſtatu, ſituque, ſuo naturali relictum adhuc eſt.

*Sextum*, quod ſub *F* conſpicitur, folii ſceleton præter reticulorum, ab invicem ſeparatorum, duplicaturam, verſus *apicem* ejus inprimis conſpicuam, etiam *utramque* folii *cuticulam*, utramque ejuſdem ſuperficiem obtegentem, exhibet, quæ adeo tenuis eſt, ut vel flatu incautiori lædi facillime poſſit.

*Septimum* tandem, quod ſub *G* videtur ſceleton, nullam quidem reticulorum duplicaturam conſpiciendam exhibet; præter *cuticulam* tamen *utramque*, folio ipſi ſuperne, inferneque incumbentem, etiam *caulis* ſeu *pediculi*, quæ illum undequaque ambit, *cuticulam* conſpiciendam ſiſtit, ipſiuſque *pediculi* in *duas* illas *partes*, quibus reticula ipſa arctiſſime adhærent, *diviſionem* exhibet, quarum altera *convexa*, altera *concava*, microſcopio obſervata apparet, niſi in quantum partis concavæ figura ipſa exſiccatione pauliſper corrugata, eoque ipſo immutata eſt.

Omnia vero hæc folia ex illo arborum genere quæ *Pyri Francicæ* nomine in genere vulgo venit, ejuſque variis ſpeciebus, deſumta ſunt, quippe quæ ex omni foliorum genere ad has operationes quam accommodatiſſima eſſe, experientia, fruſtraque in aliis multis tentata conamina, me tandem docuerunt.

Hæc ergo hactenus de *ipſa* foliorum duplicatorum *ſtructura*. De *partium* vero illarum, *duplicaturæ* inprimis, iſtius, *uſu*, conjecturas quaſdam feliciſſimo Illuſtris SOCIETATIS REGIÆ judicio peculiari quadam obſervatione, ne nimis jam prolixus ſim, ſubmittam.

## XI Samuelis Chriſtiani Hollmani, *Logic. & Metaph. in nova* Gottingenſi *Academia, P. P. O. de* Duplicaturæ fibrarum, *in foliis quibuſcunque* conſpicuæ Uſu, *aliiſque huc pertinentibus*, Conjecturæ.

QUUM illa, quæ de *duplici* in foliis quibuſcunque minimarum fibrillarum *reticulo*, facile a ſe invicem ſeparabili, & a natura ipſa diſtincto, in ſuperioribus annotata ſunt, extra controverſiam, & dubitationem omnem, videantur eſſe poſita, atque oculari demonſtratione confirmari facile cuivis poſſint; operæ jam videtur eſſe pretium, paucis hic exponere, *Quiſnam* verus hujus *duplicaturæ* videatur eſſe *uſus*. Non putamus vero, quenquam, in rerum naturalium contemplationibus vel mediocriter verſatum, adeo temere in plantarum anatome fore hoſpitem, ut ignoret, pleraſque in plantis occurrentes fibras ligneas, hiſque analogas, *tubulos*, & *canaliculos*, quamplurimos minimos efficere, quibus ſuccus nutritius, inde ab extremis radicum fibrillis, ad remotiſſimas quaſcunque partes, vehitur, atque a principio ſuo movente, quodcunque tandem illud quoque ſit, propellitur quaſi, protruditurque. Neque qui hæc noverit, etiam temere ignorabit, *fibrillas* illas minimas, quibus *caulis*, vel *pediolus*, foliorum conſtat, canaliculorum illorum minimorum *elongationem*, & *continuationem* quandam, ſolum eſſe, & *peculiarem* quendam eorundem *faſciculum* quaſi conſtituere, quibus ſuccus nutritius ad partes folii reliquas tranſmittitur, per eaſdemque diſtribuitur; quique per varias divaricationes, & quaſi ramificationes, per univerſum folii planum poſtea *explicantur*, atque a ſe mutuo magis magiſque recedunt, variis tamen *anaſtomoſibus*, multis in locis, ſibi mirifice iterum ſimul *inoſculantur*, ſicque inter ſe *cohærens* quoddam fibrillarum, & tubulorum minimorum *reticulum* conſtituant. Hoc enim omne in foliis quibuſcunque etiam non excarnatis, ſi luci copioſiori obvertantur, etiam nudo oculo, vel mediocri microſcopio obſervari a quovis facile poteſt. Neque illud tandem quoque quenquam, rerum naturalium vel mediocriter ſaltem peritum, latere poſſe exiſtimamus, quod jam proxime elapſo ſeculo multi viri celeberrimi in eam ingreſſi ſint ſententiam, quod ſuccus nutritius in *plantis* non alia, quam in *animantibus*, ratione, hoc eſt, *per circulum*, moveatur; quodque coram ipſis *Societatibus Regiis*, LONDINENSI & PARISIENSI, varia maximam huic ſententiæ veri ſpeciem conciliantia, tentamina & experimenta jam olim, recentiuſque, inſtituta ſint. Hæc omnia ergo, quando de uſu duplicaturæ in foliis, eorumque minimis quibuſcumque fibrillis, dicere jam inſtituimus, tanquam aliunde ſatis cognita, & fere jam pervulgata, hic merito ſupponimus.

Facile vero jam, his præſtructis, videri cuiquam poterat, non poſſe temere luculentius quoddam, quo illa in dubium a multis adhuc revocata, *ſucci nutritii* in plantis *circulatio* confirmari, & extra controverſiam omnem poni facilius poſſit, inveniri argumentum, quam *hanc ipſam* reticulorum in foliis quibuſvis *duplicaturam*. Quodſi *ſingulæ* enim iſtius reticuli *fibræ* totidem *tubuli* ſunt, quibus ſuccus nutritius in folium ipſum aſcendit, & per illud diſtribuitur, de quo nemo fere dubitat, atque horum tubulorum talis jam duplicatura perdemonſtrata datur, ut *ne minimus* quidem ſit, qui non *comitem* ſuum, exactiſſime ſibi reſpondentem, habeat; nihil fere manifeſtius jam eſſe videtur, quam *alterum* illorum genus *arteriarum* quaſi, *alterum* vero *venarum*, officio hic fungi, quippe quas eodem modo in corpore animali ſe perpetuo commutari mutuo, conſtat; adeoque & *alterum* illorum ſucco nutritio a radicibus ad extremos uſque apices *advehendo*, *alterum* vero eidem ab extremis arborum & plantarum apicibus ad radices *revehendo*, inſervire; ſicque motum ejuſdem *circularem*, hoc ipſo diverſo tubulorum genere, in plantis & vegetabilibus perfici.

Non eſt ille hic locus, quo diſquiri jam a me vel poſſit, vel debeat, quid mihi illi, de ſucci nutritii in plantis circulatione, ſententiæ veri videatur ſubeſſe, vel minus, quidque in experimentis, ejus confirmandæ rei cauſa inſtitutis, vel dubium, vel uberiori ſaltem diſquiſitione dignum, adhuc eſſe videatur; de quo alio forſan & loco, & tempore. *Ponamus* vero, extra omnem dubitationem jam eſſe poſitam illam ſucci nutritii in plantis & vegetabilibus circulationem; *hæc* tamen tubulorum, ſi ita appellare licet, in foliis a me jam obſervata *duplicatura* huic ſententiæ *non* omnino videtur *favere*, quam maxime id etiam vellem: majorem enim forſan tunc apud multos hoc novo invento inirem gratiam, quam nunc quidem. Etenim *initio* nondum ſatis evidens, & dubitatione omni carens, eſſe videtur, quod *reticuli cujuſvis*, ſeparatim ſpectati *fibrillæ*, illarumque divaricationes, *integri tubuli*, totidemque tubulorum integrorum ramificationes ſint, ſiquidem in ejuſmodi fibrillis, tranſverſim diſſectis, vel diſruptis, *nulla* hactenus tubulorum quorundam *orificia oſculaque*, qualia quidem in *quo-*

*rumvis lignorum* fibris, tranſverſim, ſeu horizontaliter, diſſectis, facili obſervare negotio licet, vel optimæ notæ microſcopiis detegi, a me potuerunt. Forſan ergo, dum pars alterutrius reticuli *convexa*, partis alterius *concavæ ſinu* quaſi excipitur, arctiſſimeque includitur, *tenuis* aliqua, *inſenſibiliſque*, ſolum *cavitas* inter utramque relinquitur, quæ tranſmittendo ſucco nutritio inſervit; hocque adeo modo divaricationes *utriuſque* reticuli inter ſe *conjunctæ*, *tubulorum* demum officio defunguntur. Quodſi vel maxime vero, non obſtantibus modo adductis, vellemus concedere, *ſingulas* utriuſque reticuli *fibrillas* totidem integros, perfectoſque, *tubulos*, quibus ſingulis ſuccus aliquis nutritius tranſmittatur, perque univerſi folii ſubſtantiam diſtribuatur, eſſe; *ne ſic* tamen arbitror, confici ſtatim exinde poterit, *alterius* reticuli tubulos *arteriarum*, *alterius* vero *venarum*, officio fungi, ſicque ſuccum nutritium in his reticulorum tubulis *per circulum* moveri. *Duo* enim inprimis in iſthac foliorum præparatione ſupra jam commemorata, & deſcripta, obſervavi, quæ huic ſententiæ minime videntur favere. 1°. Scilicet deprehendi, minimas utriuſque reticuli fibrillas, in *extremo* folii *margine* ſitas, terminataſque, longe *facilius* a ſe invicem ſeparari poſſe, *ſuaque* quaſi *ſponte* jam recedere, quam quæ *a margine* undequaque *remotiores* ſunt, & longius ab eodem diſtant; etſi *cuticula* utraque in *extremo margine* arctiſſime undiquaque adhuc inter ſe *cohæreat*; indeque & licet ab utroque folii reticulo, per totum ejus ambitum, ſua ſponte jam receſſerit, *hic* tamen cultello adhuc *diſſecanda* ſtudioſe ſit, ſi altera ejuſdem lamella recedere ab altera debeat: id quod evidentiſſimo videtur eſſe argumento, *fibrillarum* utriuſque reticuli *extremitates* in *margine* folii *non* inter ſe *cohærere*, atque *arteriarum* inſtar in *venas* ſuas *recurvari, replicarique*, ſiquidem omnium arctiſſime alias tubuli iſti ſubtiliſſimi, hoc inprimis in loco, cohærere inter ſe deberent. 2°. Illud quoque annotatione dignum hic eſt, quod non raro mihi eveniſſe memini: Contigit nempe aliquoties, ut, quando altera folii, aquæ innatantis, ſuperficies durante putrefactionis tempore ex aqua aliquantulum prominuit, *hæc ipſa* ſuperficies quoque tum *minus*, quam *altera*, ſub aquam depreſſa, eademque undiquaque contecta *putrefactione* ad ſceleti præparationem *apta* facta fuerit, difficiliuſque & cuticulam, ipſi impoſitam, dimiſerit, & partes viridulas, inter reticuli lacunas interpoſitas, cui aqua permiſerit, quam in *altera* quidem ejuſdem folii ſuperficie utrumque ſucceſſit. Hoc ergo quando jam evenit, microſcopio aliquoties obſervavi, *inferius*, ſi putrefactionis ſitum, ſtatumque, reſpicias, ejuſmodi folii reticulum *omni*, inter ipſas ejuſdem divaricationes & lacunas alias hærente, pulpa viridula *denudatum* jam conſpici, *hærente* eadem adhuc, intimeque *infixa*, intextaque, inter *alterius*, *ſuperioris* nempe eodem reſpectu, reticuli divaricationes, & lacunas: id quod quilibet, qui manum modo ipſi rei admoverit, facile ipſe quoque, data occaſione, obſervare poterit. Quum ex hoc ipſo ergo evidens ſatis ſit *ipſam* etiam *pulpam* illam ſubtiliſſimam *vireſcentem*, quæ utrique folii cujuſcunque cuticulæ proxime ſubjacet, eademque ſeparata ſponte ſua, maximam partem, plerumque, poſt debitam putrefactionem, effluit, in *duas* non minus *lamellas*, & *ſtrata* quaſi totidem *diverſa* diſtinctam eſſe, quorum alterum *uni*, alterum *alteri*, folii reticulo intime, arctiſſimeque, intertextum quaſi eſt; maxime etiam videtur eſſe evidens, *alterum* folii *reticulum* generandæ & nutriendæ *uni*, alterum *alteri*, foliorum quorumvis *ſuperficiei* inprimis inſervire, huicque uſui a Creatore ſapientiſſimo deſtinatum etiam potiſſimum eſſe.

Quum hac ergo ratione de Duplicaturæ iſtius, in foliorum quorumcunque ſceletis, uſu jam quodammodo conſtet; *alia* nonnulla ad hoc argumentum pertinentia hic adjicere adhuc liceat, quorum primum *generationem pulpæ* iſtius *viridulæ*, quæ inter reticuli utriuſque lacunas, in folio vireſcente, utrinque interjacet, inprimis concernit. Conſtat mihi ſcilicet ex plurimis circa plantas & vegetabilia inſtitutis & obſervationibus & experimentis, *primum*, quod ex ſucco nutritio in vegetabilibus procreatur, *concretum* formam quandam *veſicularem*, & *utricularem*, ſemper præ ſe ferre; unde & dudum *utriculorum* nomine a Rerum iſtarum peritis ſcriptoribus compellatum idem eſt. Patet id ex *medulla* quarumcunque arborum, patet ex *cortice* earundem *viridi*, patet ex *florum*, ex terra *immediate* prognatorum plerorumque, *caulibus*, ipſiſque *horum*, & ex *arboribus* protruſorum, *florum*, tum & reliquis *communibus* plantarum quarumcunque, *foliis*, in quibus vel nudo ſæpius oculo utricularis, & veſicularis, illa figura conſpici facile poteſt. Jam vero, experientia porro conſtat, quod, quotieſcunque *liquidum* paulo *viſcidius*, vel partibus quibuſdam ſalinis & oleoſis imprægnatum, per *tubulos* quoſdam *anguſtiores*, leniori aëris agitatione & quaſi ſuffocatione propellitur, ſemper illud in *veſiculas* nunc plures, nunc pauciores, in tubulorum illorum extremitatibus expandatur, id quod vel *puerorum* noſtrorum *luſu*, aqua *ſapone* ſaturata fieri ſolito, in vulgus conſtat.

ſtat. Quoniam ex anatome vero plantarum conſtat, partes, fibraſque, illarum ſolidas maximam partem *tubulos, canaliculoſque*, minimos conſtituere, quæ inde a *radicum* fibrillis ad *extremos* uſque *frondium* in plantis perfectioribus *apices* excurrunt; neque minus conſtat ſuccum nutritium nulla fere *alia* vi, quam *aëris*, radicum fibrillis incumbentis & *gravitate*, & *vi elaſtica*, ad frondium apices propelli; probabile admodum eſt, ſuccum nutritium, aëris vi per tubulos plantarum anguſtiſſimos, ad illorum uſque extremitates propulſum, in *veſiculas* quaſdam minimas expandi, poſtque partium aquearum inſenſibilem tranſpirationem *ſolideſcere*, formamque illam veſicularem retinere, ſicque primum illud concretum veſiculare, & utriculare, in plantis formari. Atque ex ſimpliciſſima hacce theoria omnia fere circa nutritionem, & incrementa, plantarum occurrentia phænomena explicari, illiſque, quæ a viro ſolertiſſimo, eruditiſſimoque, STEPHANO HALES, in *the Vegetable Statics*, jam obſervata ſunt, lucem aliqualem affundi adhuc poſſe exiſtimo, uti alio tempore pluribus oſtendam. Hoc ergo modo viridulam quoque illam ſubſtantiam, eamque veſicularem, & utricularem, ex minimis reticuli cujuſvis tubulis, illorumque extremitatibus, in *foliis* quaſi exſudare, atque minimis illis tubulis adhæreſcere, ibidemque intra cuticulas ſenſim paulatimque magis indurari, ſicque *cum tubulis* illis, ex quibus protruditur, quorumque lacunis intertextum quaſi eſt, in *utroque* folii cujuſvis *reticulo commune* & *continuum* quoddam *expanſum* tandem efficere, admodum mihi eſt probabile. Quæ *cauſa* vero *divaricationis* tubulorum ipſorum a ſe invicem ſit, etſi ex iiſdem fundamentis intelligi jam poterat, pluribus tamen explicari jam in præſenti nequit. Quoniam *pulpa* vero illa *viridis* longe *tenerioris* adhuc, *mollioriſque*, quam *ipſi* reticulorum *tubuli* ſunt, ſubſtantiæ eſt; *facilius* quoque *putrefactione* eroditur quaſi, & deſtruitur, dum *tubuli* reticulorum ipſi *integri* adhuc, *illæſique* a putrefactione iſta ſuperſunt, illaque omni ex parte denudati conſpici diſtinctiſſime poſſunt.

Hoc ipſum vero jam *alteram* illam obſervationem mihi ſuppeditat, quæ annotatione aliqua adhuc digna eſſe videtur. Etenim ſæpius mihi in *lapidibus figuratis*, qui *plantarum* variarum, etiam exoticarum, figuras referunt, atque ejuſmodi quoque plantas, cum omnibus ſuis ramificationibus expreſſas, ſæpe exhibent, quæ adeo *teneræ*, & *ſubtiles*, ſunt, ut nullæ, illis ſimiles in univerſo naturæ regno ullibi exiſtant, dubium movit, undenam illarum figuræ oriri in lapidibus iſtis potuerint. Certe in montibus, *Gottingam* noſtram cingentibus, magna ejuſmodi lapidum copia jam eruitur, & ad conſtruenda ædificia, publica privataque, immo & ad ſternendas urbis vias plateaſque, adhibetur, quæ præter varii generis *conchylia petrefacta*, tum & *ſtellas marinas*, *cornua* ita dicta *Ammonis*, & ejuſmodi alia, ingenti multitudine ſinu ipſorum comprehenſa, inter conchyliorum *juncturas*, immo in *ipſis* nonnunquam *conchyliis* petrefactis, adeo affabre factas *ſubtiliſſimarum arbuſcularum* delineationes exhibent, ut nudo oculo vix adſequi omnia liceat, meritoque dubitandum ſit, eſſe in tota natura nullum ejuſmodi plantarum genus, quod ſubtiliſſimos adeo ramuſculos habeat. Poſt ſceletorum vero illorum præparationem, factamque iſtam obſervationem, quod putrefactione *pulpa* illa viridis *facilius*, quam ipſi *reticulorum* tubuli, corrumpatur, dubium fere illud, mihi ſubortum, jam expiravit. *Subtiliſſimæ* enim illæ in *lapidibus*, vel *corporibus* etiam *petrefactis*, delineatæ *arbuſculæ* nihil jam videntur eſſe aliud, quam ipſa *foliorum* hujus vel illius plantæ, *poſt putrefactionem* illorum adhuc *reſidua, reticula*, quæ, poſt reliquorum corruptionem, figuram ſuam maſſæ iſti molliori, quæ in duriorem ſucceſſu temporis lapidem abiit, impreſſam, delineatamque reliquerunt ita, ut *ipſa* non raro in *lapideam* ſubſtantiam commutata deprehendantur. Apud me ſaltem hæc, ob ſummam reticulorum iſtorum, cum ſubtiliſſimis illis arbuſculis, affinitatem, dubitatione omni carent: forſan vero & aliis iſthæc non omni probabilitate deſtitui videbuntur.

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## XII. *An Account of an* Earthquake *at* Scarborough, *on* Dec. 29. 1737. *communicated in a Letter from* Maurice Johnſon, *Eſq; jun. Secr. of the* Gentlemens Society *at* Spalding, *to* C. Mortimer, *M. D. Secr.* R. S.

*S I R,* *Spalding, Jan.* 7. 1737-8.

SINCE I laſt did myſelf the Honour of writing to you, nothing, I think, worth communicating to you for the ROYAL SOCIETY, in the philoſophical Way, has occurred to us here, until laſt *Thurſday*, when the following Account of an Earthquake, which has very lately happened at *Scarborough*, as ſent in a Letter from an Eye-witneſs, to a Gentleman here,

was read, dated thence the 30th of *December* 1737. in theſe Words:

—"The Ends of ſeveral Incloſures or Fields behind the Clift, on the Back of the Spaw, ſunk down very low into the Ground, making a large Valley of a vaſt Length, and conſiderable Breadth, with Five Cows then grazing on it (which they got out this Morning), the Weight of which ſhook and opened the Hill behind the Houſe, after a frightful Manner, and forced up the Sands an hundred Yards in Length on each Side the Space, and Twenty-ſeven broad, to the Height of Six Yards, and in ſome Places Ten Yards high.

"The Pier, intire as it was, moved ſideways out of its Place, and roſe up about Five Yards in the Air; the Houſe fell down, and at the ſame time took Fire.

"The Flag-houſe, and wooden Rails, which were about the Mouth of the Well, were forced up in the Air above Ten Yards high, ſo that it is thought the Spaw-water is intirely loſt for ever *.

"The Tide was out when this happened, and I was walking on the Spaw till after 12 o'Clock, when I ſaw the Sands beginning to riſe about half a Foot: There were but few People there then, but in leſs than Two Hours the Sands were covered with Men, Women and Children, to ſee the Sands and Pier riſe gradually; which they began to do about 12 o'Clock Yeſterday Noon, and were at the Height I mention before it was dark, and continues ſo now.

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* *N. B.* The Spaw was ſoon after recovered as good as before.

“ Nobody came by any Hurt, the People of the
“ Houſe getting away in Time; but all *Dickey's* *
“ Houſhold-goods are loſt, with a Cellar well ſtocked
“ with Wine and Ale.”——

Now, Sir, though this Repreſentation be not altogether ſo accurate, in every Part of the Relation, as we could have wiſhed; yet coming from an Eye-witneſs, and who happened to obſerve it from the firſt Motion, and is eſteemed a Perſon of Fidelity, we thought it might not be unacceptable to the ROYAL SOCIETY, and to you, Sir, and which, if the moſt learned and worthy Preſident judge proper, you may be pleaſed to communicate to that Learned and Illuſtrious Body, with our moſt humble Services. I am,

*Your moſt obedient,*
*and obliged humble Servant,*

**Maur. Johnſon, *jun.***

## XIII. *An Examination of* Sea-water *frozen and melted again, to try what Quantity of* Salt *is contained in ſuch* Ice, *made in* Hudſon's Streights *by Capt.* Chriſtopher Middleton, F. R. S. *at the Requeſt of* C. Mortimer, R. S. *Secr.*

DR. *Hales*, in his learned Paper lately read at the ROYAL SOCIETY, wherein he propoſes a Method of rendering Sea-water freſh, and wholſome to drink, mentions a Diverſity of Saltneſs of the Water at the *Nore* in the Mouth of the *Thames*, and the Water taken up in the *Mediterranean Sea*, this containing $\frac{1}{27}$ of Salt, the former $\frac{1}{29}$. Mr. *Boyle*, in his Obſervations of the Saltneſs of the Sea, *p*. 4. ſaith, that about *Holland* the Salt in the Sea-water hath been found to be $\frac{1}{40}$. In the *Engliſh* Chanel, *p*. 31. he found Sea-water $\frac{1}{45}$ heavier than Conduit-water; and, by immerſing a Lump of Sulphur in it, he found the Difference $\frac{1}{53}$; but by Diſtillation *ad ſiccitatem*, *p*. 33. he found the Salt to be $\frac{1}{30}$, and in another Trial $\frac{1}{37}$. It is certain the Sea differs in Saltneſs in different Parts: It is, in general, obſerved, that in hotteſt Climates the Water is the ſalteſt. At *Moſambique* Mr. *Boyle*, *ib*. *p*. 29. relates an Inſtance of a Ship drawing Two Handsbreadth leſs Water than uſual. On the contrary, when Salt-water Freezes, it hath been thought to let fall all its Salt; the Ice of Sea-water, and the Water melted from it, taſting freſh, and being good for boiling Meat and Peaſe in: Capt. *Middleton*, being in *Hudſon's Streights* in *July* 1738. took Ice from under the Surface of the Sea, which he melted till he got 40 Quarts of Water, which he evaporated to Dryneſs, and out of that Quantity had only Six Ounces of Salt, or about $\frac{1}{213}$.

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* *Richard Dickinſon.*

## XIV. *A Rule for finding the* meridional Parts *to any* Spheroid, *with the ſame Exactneſs as in a* Sphere, *by* Colin Mac Laurin, F. R. S. *Communicated by* Andrew Mitchel, *Eſq;* F. R. S.

IT was demonſtrated long ago, that in a Sphere the Nautical Meridian Line is a Scale of logarithmic Tangents of the half Complements of the Latitudes. The ſame may be computed with no leſs Exactneſs to any Spheroid by the following Rule.

Let the Semidiameter of the Equator be to the Diſtance of the *Focus* of the generating Ellipſe from the Centre as $m$ to 1. Let $A$ repreſent the Latitude for which the meridional Parts are required, $s$ the Sine of this Latitude, the *Radius* being Unit; find the Ark $B$, whoſe Sine is $\frac{s}{m}$; take the logarithmic Tangent of half the Complement of $B$ from the common Tables; ſubtract this logarithmic Tangent from 10.000000, or the logarithmic Tangent of 45°; multiply the Remainder by $\frac{7915.7044678978.}{m}$ *&c.* and the Product ſubtracted from the meridional Parts in the Sphere, computed in the uſual manner for the Latitude $A$, will give the meridional Parts expreſſed in Minutes for the ſame Latitude in the Spheroid, provided it is oblate. When the Spheroid is oblong, the Difference of the meridional Parts in the Sphere and Spheroid for the ſame Latitude, is then determined by a circular Ark; but it is not neceſſary to deſcribe this Caſe at preſent.

*Example:* If *mm* : 1 :: 1000 : 22. then the greateſt Difference of the meridional Parts in the Sphere and Spheroid is 76,0929 Minutes: In other Caſes it is found by multiplying the Remainder above-mentioned by 1174.078.

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## XV. *The* parabolic Orbit *for the* Comet *of* 1739. *obſerved by Signor* Euſtachio Zanotti *at* Bologna.

THE Motion in its own proper Orbit was retrograde.

| | | ° | ′ |
|---|---|---|---|
| The *Perihelion* was in | ♋. | 5. | 11. |
| The deſcending Node in | ♈. | 25. | 18. |
| The *Perihelion* from the Node | | 69. | 53. |

| | d. | h. | ′ |
|---|---|---|---|
| The Comet was in the *Perihelion* *June* | 9. | 9. | 59. |
| in the deſc. Node *July* | 18. | 4. | 57. |

The *Perihelion* of the Comet's Orbit was within the Sphere of the Orbit of *Venus*, and without that of the Orbit of *Mercury*; being diſtant from the Sun 0,69614 Parts of the Earth's mean Diſtance from the Sun.

The Plane of the Orbit ſtood inclined to the Plane of the Ecliptic in an Angle of 53°. 25′.

The Diurnal mean Motion, according as it is interpreted by Dr. *Halley* in his Elements of cometical Aſtronomy, was 1°,5707.

## XVI. *A Letter from the Right Rev$^{d}$ Father in God* Robert *Lord Biſhop of* Corke, *to the Right Hon$^{ble}$* John *Earl of* Egmont, F.R.S. *concerning an* Extraordinary Skeleton, *and of a* Man *who* gave Suck *to a Child.*

*My Lord,* *Corke, Aug.* 8. 1738.

AS I am juſt come from ſeeing a moſt extraordinary natural Curioſity, I cannot forbear letting your Lordſhip partake with me in the Amuſement.

It is the Skeleton of a Man, whoſe Bones, during his Life-time, were almoſt all grown into one intire Bone, [ſee Tab. V. Fig. 1. 2.] ſo that now his Fleſh is taken from them, he is, without further Trouble, one intire Skeleton. The only Bones he could move before his Death, were the Wriſt of his Right Hand, and the Bones of his Knees, ſo that he could move his Legs a little; and, when ſet upright, could in about a Quarter of an Hour get a Foot forward.

For many Years before his Death, he could not alter his Poſture in the leaſt. His Name was *William Clarke*. He was maintained till his Death by one Mr. *Aldworth* in this County. He was valued by his Maſter on account of his Honeſty. The only Uſe he was capable of being put to, was that of watching the Workmen; for, when he was once fixed in his Station, it was impoſſible for him to deſert it.

At about 18 Years of Age he began to be unwieldy, and ſo continued growing more ſtiff, till he loſt all Uſe of his Limbs, and died in the 61ſt Year of his Age. The Poſture into which he fixed at laſt, is ſomewhat like that of the *Venus* of *Medicis*, only that his Right Hand is the loweſt, and the Left Hand does not riſe higher than the Elbow of the Right. He was originally deformed, his Left Shoulder riſing higher than his Right; the *Vertebræ* of his Back are exceedingly bent inwards towards the lower Part, with an Inclination towards the Left Hip. The *Os Sacrum* is ſo bent outwards, that you have no Sight of it at all as you view the Skeleton in Front. His Left Knee does not come down ſo low as the Right by Three or Four Inches. There is hardly one Bone in his Body in the Figure it ought naturally to be, except the Bones of his Legs, which are not much diſtorted.

He is one intire Bone from the Top of his Head to his Knees. I ſhall endeavour to give your Lordſhip ſome Account of it, becauſe I think it one of the moſt extraordinary things I ever ſaw, though it will be very difficult for me to do it, it being ſo many Years ſince I have ſeen any thing of Anatomy, and of Conſequence have forgotten the Names of the Bones belonging to the various Parts of the human Body.

His Head ſeems regular, and the Sutures pretty diſtinct, though more united than in common Skulls. His Jaw-bones ſeem intirely fixed and grown together, as are alſo the Teeth in the hind Part of the Jaw. His fore Teeth are very irregular, which left a Vacancy for him to ſuck in his Food at. Out of the Back of his Head there grows a Bone, which ſhoots down towards his Back, and paſſes by the *Vertebræ* of the Neck at about an Inch Diſtance:

This

This Bone unites to the *Vertebræ* of the Back, and the *Scapula* of the Left Shoulder, from whence it diſengages itſelf again, and continues diſtinct, till it divides into Two towards the Small of the Back, and fixes itſelf into both the Hip-bones behind. The *Vertebræ* of the Neck and Back are one continued Bone.

In the fleſhy Part of his Thighs and Buttocks Nature ſeems to have ſported herſelf, in ſending out various Ramifications of Bones from his *Coxendix* and Thigh-bones, not unlike the Shoots of white Coral, but infinitely more irregular; ſome behind, and ſome before; ſome in Clumps and Cluſters, and others in irregular Shoots of Eight or Nine Inches in Length. You cannot paſs your Hand between his Two Knees, which incline much towards the Right, his Left Shoulder having been the higheſt. One of the Bones of his Left Arm was once broken by a Fall, and Nature has ſhot out another Bone a little above the bending of the Arm, which unites to the broken Bone, and makes it much ſtronger than it was before, though the Bone ſeems more liable to decay about the Place where it was formerly broken. All the Cartilages of his Breaſt, Four only excepted, were turned to Bone. Theſe Four ſerved to move his Breaſt in Reſpiration.

Out of his Heels there frequently grew Bones like the Spurs of a Cock, Two or Three Inches long, which he ſhed as a Deer does his Horns. When he was diſſected, there was a Bone found in the fleſhy Part of his Arm, quite diſtinct and diſengaged from any other Bone; it is very thin, about Four Inches long, and the Fourth-part of an Inch broad, with ſeveral Ramifications. What is very odd, is, that while theſe Bones were growing, he never complained of any Pain in his Muſcles.

This Skeleton belongs to Dr. *Barry*, an ingenious Phyſician in this Town, whom I intend to perſuade to publiſh a Treatiſe about it, and to get Three or Four Copper Plates taken from the different Views of it.

And now that I am engaged in writing, I will venture to give an Account of a Man that I met at *Iniſhanan*, about 10 Miles from this Place. He was an old Man about 70 Years of Age, by Birth a *Frenchman*, but was a Refugee on account of his Religion, was bred a Gardener, and, by all Accounts, had been induſtrious, till deprived of his Strength by Age.

He asked me for Charity, and I gave him half a Crown. I mention this Particular, that the remaining Part of the Story may not ſeem to be told for the ſake of Gain. After I had done this, and was gone into the Houſe, I heard a Noiſe at the Door: The Man, out of Gratitude, had returned to ſhew me a Curioſity, which was that of his Breaſts, with which he affirmed he had once ſuckled a Child of his own: His Wife, he ſaid, died when the Child was about Two Months old: The Child crying exceedingly while it was in Bed with him, he gave it his Breaſt to ſuck, only with an Expectation to keep it quiet; but, behold, he found that the Child in time extracted Milk; and he affirmed, that he had Milk enough afterwards to rear the Child. I looked at his Breaſts, which were then very large for a Man; but the Nipple was as large or larger than any Woman's I ever ſaw. Some Ladies were then paſſing by; ſo I ſent him off in Haſte, and have not ſeen him ſince.

I have either heard or read of one Inſtance of this kind before.

I ſhall make no Apology for giving you the Trouble of this long Letter, but that of aſſuring you that I am with great Sincerity

*Your Lordſhip's*
*moſt obedient,*
*humble Servant,*

**Robert Corke.**

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## XVII. *Extracts of Two Letters from the Rev$^{d}$ Dean* Copping, F. R. S. *to the* Preſident; *concerning the* Cæſarian *Operation performed by an ignorant Butcher; and concerning the extraordinary* Skeleton *mentioned in the foregoing Article.*

*SIR,* *Dublin, March 16. 1737-8.*

I Have tranſcribed a Caſe, which I received from a young Clergyman, who ſome time ſtudied Phyſic, and knows the Woman: I ſhall probably ſee her at *Clogher*, where ſhe now lives. The Caſe happened within theſe Two Years, but I cannot learn the exact Date at preſent.

*Sarah M$^{c}$ Kinna*, who now lives at *Brentram*, Two Miles from the City of *Clogher*, in the County of *Tyrone*, was married at the Age of Sixteen Years. ——Before her Marriage ſhe never had the Appearance peculiar to Women; but, in a Month after her Marriage, thoſe Appearances ſhewed themſelves properly. Ten Months after her Marriage, ſhe found the Symptoms of Pregnancy, and bore a Child at the Expiration of the uſual Time. Ten Months after, ſhe was delivered of another; and each time had a ſpeedy and eaſy Delivery.

Two Months after her ſecond Lying-in, Symptoms of Pregnancy appeared again, and increaſed in Proportion to the Time; but at the End of Nine Months thoſe Symptoms began to dwindle, and in a little time ſhe had no other Reaſon for thinking ſhe was with Child, but an abſolute Stoppage of her *Catamenia*: Nor had ſhe, during the Space of Six Years and ſome Months, any one Return of them; but for the greateſt Part of that Time, eſpecially the Four firſt Years, ſhe was perpetually afflicted with moſt violent Pains in the middle Region of the *Abdomen*.

Some time in the Seventh Year after her laſt Pregnancy, which ended in ſuch an unuſual Manner, a Swelling in her Belly, and other Symptoms, made her conclude ſhe was again pregnant.

About Seven Months after this uncertain Account, a Boil, as ſhe thought, appeared about an Inch and an half higher than her Navel.

During this time of her Pregnancy ſhe often found the Symptoms of her being quick with Child, till about Six Weeks before this Boil (as ſhe calls it) appeared. It was attended with very great Pain.

She ſent for one *Turlogh* [*Terence*] *O Neill*, a Butcher, who then did, and does now live with Capt.

*George Gledſtanes*, about a Mile from *Clogher*. This Man came to her the *Sunday* after her Meſſage, and found her in an expiring Condition. By this time, the Impoſtumation (which ſhe apprehended to be a Boil) had broken, and an Elbow of the Child had forced itſelf through it, and appeared in View. At the Requeſt of herſelf and Friends, he undertook to adminiſter Relief to her, and made ſo large an Inciſion above and below the Navel, as enabled him, by fixing his Fingers under the Jaw of the *Fœtus*, to extract it; in which Operation he met not with the leaſt Impediment. He afterwards looked into her Belly, and ſeeing ſomething black, he put in his Hand, and extracted, by Pieces, a perfect Skeleton of a Child, and ſeveral Pieces of black putrefied Fleſh. After the Operation, he ſwathed her up; and in Six Weeks ſhe purſued her domeſtic Buſineſs.

She has been in good Health ever ſince this wonderful Accident happened; only ſhe has a Navel-rupture, owing to the Ignorance of the Man in not applying a proper Bandage. I am, &c.

*J. Copping.*

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*Clogher (Ireland) June 2. 1738.*

—I Have ſeen the Woman, of whom I ſent you the ſurpriſing Account, with her Huſband, and inquired more particularly into the Fact; but hope to be ſtill a little more particular, when I ſee the Man who extracted the Child. They are ſo ignorant, that, with their bad Language, I could not make myſelf quite Maſter of what they ſaid; but, if they ſpeak true, there is ſomething more ſurpriſing than the former Account mentioned: For the ſeveral Parts of the latter, or rather the former, *Fœtus*, were extracting by Degrees, from *July* to *Chriſtmas*.

She had, by their Account, been married about Eight or Ten Years before her firſt Pregnancy.

As well as I could apprehend them, ſhe had a Midwife at the proper Time, in her firſt Pregnancy, for Eight Days, Day and Night: When the Symptoms diſappeared, the Swelling decreaſed, and People concluded there was no Child.

This Child was carried for Seven Years, till ſhe had been again pregnant for Nine Months; about which time there was a Swelling in her Navel about the Bigneſs of a Gooſe-egg, which broke in a ſmall Orifice, of itſelf, and diſcharged a watry Humour.

She had a Midwife, and Three or Four Phyſicians, who gave her over, and left her as a dying Woman. From this Orifice ſtarted the Elbow of a Child, which hung ſome Days by the Skin, viſible to abundance: At length ſhe cut it off for her own Relief.

When *O Neile* came, (whom I have not yet ſeen, but ſhall ſoon) ſhe begged him to help her. The Man was frightened, and went to ſleep; but, when he got up, gave her a large Draught of Sack, and, I ſuppoſe, took one himſelf; when he opened the Place, and made ſuch a Hole as the Man deſcribes to be as large as his Hat. He put in his Hand, took hold of the Second Bone of the Child, and, pulling it backward and forward to looſen it, in a little time extracted the Child. After this, looking into the Hole, and ſeeing ſomething black, he put in his Hand, and extracted other Bones. Some Bones ſtill remained, which, as I ſaid, were extracted at different times, it ſeems too in different ways: for ſome came by the Navel, others from the Womb the natural Way. She had great Pain at each time.

The former Account ſays, ſhe purſued her domeſtic Buſineſs: She might be about the Houſe, but ſhe was 15 Months confined to the Houſe. I have examined the Rupture, and can put a Finger a pretty Way up into the Body. Mr. *Dobbs*, I hear, an eminent Surgeon at *Dublin*, thinks there may be Relief, and that the Rupture may be much helped, and the Guts reduced. I queſtion whether he will think ſo, when he ſees her. However, I have collected about Four Pounds for her among the Gentlemen that viſit my Lord Biſhop, ſhall buy her ſome Cloaths, and ſend her to *Dublin* about 10 Days hence, to the Infirmary. She was fond of going, but her ignorant *Prieſt*, and ſome other ignorant Neighbours, told her they would keep her till ſhe dies: But, upon my anſwering thoſe Difficulties, ſhe conſents to go; her Huſband will carry her; and they are ſo thankful to me for entering ſo much into their Condition, that they now ſay ſhe ſhall go to *London*, or where-ever I pleaſe. I am ſorry the ſeveral Bones extracted were carried away by different Phyſicians, that I cannot procure one to be ſent to you; which, with the Account, might find a Place in your ſurpriſing Collection.

I have wrote ſo long a Letter, that, by way of Apology, and to make ſome Amends, I muſt make it ſtill longer by another Account, which a worthy Clergyman gave me by Strength of Memory, from the Letter of a Phyſician to him.

*William Clark*, a poor Man of the County of *Corke*, about 18 Years of Age, complained of a Stiffneſs in his Joints, which by Degrees increaſed till it came to an univerſal *Anchyloſis*: That is, all his Joints were immoveable or oſſified. He lived in this Condition 38 Years, and Dr. *Barry*, the Phyſician at *Corke*, has made a Skeleton of him; and his Account of it is this [ſee Tab. V. Fig. 1. 2.]: Not one Bone in his Body has the natural Form; for all his Joints are immoveable and oſſified: And ſuch a luxuriant Diſpoſition had all the Humours of his Body to turn into Bone, that many little Branches of Bone, like Coral, ſpring from the Joints and ſeveral Parts of the Body. The whole Spine is oſſified, and one intire Arch of Bone there is from the *Occiput* down to the *Os Sacrum*; out of which ariſes a very protuberant Bone, which ſerves as a fine Handle to the Skeleton. A ſharp Horn, like a Cock's Spur, grew out of his Heel every Year. The Extract concludes thus: “It is as difficult to give a particular and exact “Deſcription of this curious *Memento mori*, as of “*Calypſo*'s Grotto.” I am promiſed very ſoon a complete Hiſtory of his Life, and I ſhall endeavour to tranſmit *William Clark*'s Name to future Ages.

*Signed*,

John Copping.

**Tab. V.**

Fig. 1. *The Front of the Skeleton.*
2. *The Back-ſide of it.*

## XVIII. *Part of a Letter from Mrs.* —— *to Sir* John Shadwell, *Knt. M. D.* Fellow *of the* Royal College *of* Phyſicians, London, *concerning the extraordinary* Skeleton *mentioned in the Two preceding Papers.*

THE Man died in the County of *Corke*, 20 Miles from that City: When I was there, he was Steward to Mr. *Allworth*, his Name *Clark*; the Account I am going to give, I had from the Lady he lived with. Twenty Years before he died, he got a violent Fever, by being very warm, and ſleeping on the Graſs, moſt Part of a Night. After he recovered from that Diſorder, he was never free from great Pains in his Bones, and in Four Years loſt the Uſe of all his Limbs, even the moving his Jaws, that they were obliged to take out many of his Teeth, in the Front of his Mouth, to give him Suſtenance, Spoon-meats, and Ale, on which he lived 10 Years: In thoſe Years he could neither ſit or lie down, but ſlept in a Sentry-box, with a ſmall Board which ran in a Groove, and againſt that he leaned his Stomach: He could never move his Head, by a Bone that grew from his Scull to his Back-bone. I wrote you before, that he ſlept in the Box, but ſhould have let you know, he did not live in it; for whenever the Weather would permit, he got into the Air: He could move himſelf on even Ground, with a little kind of Jump, and ſtand many Hours in the Garden, leaning his Back againſt a Tree, or Wall: They think his moving with that Motion, and being ſo much in the Air, kept him alive ſo long. The Picture * [ſee Tab. V. Fig. 1. 2.] is within Four Inches in Length and Breadth of the Bones. It is done by a very good Hand, and very exact; and every thing I have wrote to be depended on; and taken from the Bones; it is not a Copy. I was in Haſte: Mr. *Vandenhagen*, who drew it, finiſhed mine, and died ſuddenly, before he had quite done.

## XIX. *A* Narrative *of a new Invention of* expanding Fluids, *by their being conveyed into certain ignified* Veſſels, *where they are immediately rarefied into an elaſtic impelling Force, ſufficient to give Motion to* Hydraulopneumatical *and other* Engines, *for raiſing Water, and other Uſes*, &c. *by* John Payne.

TO produce a great Power at a ſmall Expence, is what every body deſires in moving Machinery; and is what, by this new Invention, we have proved by Experiments and Practice to be a great Improvement, when applied to that noble Invention the *Fire-engine:* Therefore I ſhall proceed to give a ſhort Deſcription of the Veſſels and Machinery contrived for that Purpoſe; *viz.*

A Pot or Veſſel made of wrought or caſt Iron, nearly the Figure of a Cone, whoſe Diameter at the

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* Now in the *Muſeum* of Sir *Hans Sloane.*

Baſe is Four Feet, with Holes round the Edge, for Nails or Screws to faſten a globular Head of Copper of about Five Feet and half Diameter, as by the Figure annext will appear [TAB. VI. Fig. 2]. There is then placed in the Inſide a ſmall Veſſel or Machine, which I call a Diſperſer: This Baſon or Veſſel hath Spouts round the Sides fixed to it, and the Bottom thereof reſteth on a Centre-pin; and in the Middle of this Baſon or Veſſel is a Socket, with Holes near the Bottom, to let the Water or Fluids paſs from above, through an iron Pipe of about Seven Feet long, the lower End of which is placed in the Socket, ſo as the End of the Pipe will be always immerged in Water in the Baſon, to prevent the expanded Fluids from returning up the Pipe; and the other End of this Pipe goes up through the Copper-head, which is incloſed very tight, but ſo as it may eaſily be moved with a circular Motion, in order that the Water or other Fluid, which is conveyed through this iron Pipe down into the Diſperſer, may be diſperſed or ſhowered round, on the Sides of the red-hot Pan, or ignified Veſſel, in a very exact manner.

This evaporating Veſſel being thus completed, we then take One, Two, or more, of theſe Veſſels, with their Contingencies, and place it or them in a reverberatory Arch or Canal, for conveying the intenſe Heat of a ſtrong Fire, the Flame of which encompaſſes the metal Pot or Pots, and brings them to a red Heat; and in that Condition they are continually kept, while in Uſe, with the Water running from a Ciſtern or Veſſel (where the Water is heated) through a Gauge-cock down the iron Pipe into the Diſperſer, which conveys it to the Sides of the ignified Veſſel or

Pot, when it is immediately rarefied or expanded into an elaſtic Steam or Vapour, fit for Application to give Motion to ſundry ſorts of Machinery, *&c.*

TAB. VI. Fig. 1.

1*ſt*, A, *A Globe made of Copper*, 12 *Inches Diameter.*
B, B, *Two braſs Cocks, one oppoſite to the other, fitted very tight.*
C, *A Handle or Bale, faſtened to the Globe, by which it may be hung or held up.*
D, *A ſmall Valve or Clack, fitted to the upper Cock, of One Inch Diameter.*

The Whole, thus fitted, weighed 15 Pounds 3 Ounces *Troy*, or 12 Pounds 9 Ounces ½ *Avoirdupois*; and, filled with Water, it weighed 45 Pounds 7 Ounces, from which deduct the Metal, the Weight of Water is 32 Pounds 13 Ounces ½ *Avoirdupois*, which is about 4 Gallons, containing about 925 cubical Inches.

This Veſſel or Globe I then hung over the large Veſſel F, in which Water was rarefied or converted into Steam; and by the Pipe E, at the large Cock G, which being open, as alſo the other Cocks BB, the Steam had a free Paſſage through the Globe A, by which the Steam excluded or forced out the Air that was in the Globe, and by its elaſtic Quality ſupplied its Place; when both Cocks BB were ſuddenly ſhut, and the Globe A taken down and hung over a Veſſel of cold Water, with the lower Cock B, immerged in Water, and then opened under Water; on which the Water ruſhed into the Globe very furiouſly, until it had ſupplied the *Vacuum*, when the Cock was again ſhut, and the Globe, with the Water, put in the Scales, and then found to weigh 44 Pounds 9 Ounces; which take from 45 Pounds 7 Ounces, the whole Weight, as before, there remains but 14 Ounces, the Difference, which ſheweth that all the Air was nearly excluded out of the Globe by the Steam: In Ounces it ſtands thus [illegible], which is very near a perfect *Vacuum*.

2*dly*, I again excluded the Air out of the Globe with Steam as before, and both Cocks B B being cloſed with the Globe full of Steam, we put the Globe in the Scales, and it weighed 12 Pounds 12 Ounces $\frac{1}{2}$. I then opened one of the Cocks, and let in the Air, on which the Scale deſcended; and, by adding Weight in the other Scale, it was found to weigh 12 Pounds 11 Ounces; which ſhewed that the Weight (not the Preſſure) of the Air the Globe contained, was $\frac{1}{2}$ an Ounce *Avoirdupois*.

3*dly*, The Globe being filled with Steam, as before, and condenſed with cold Water on the Outſide of the Globe, and the Metal again made very dry, and the Air let into the Globe, the Water from the condenſed Steam was found to weigh 4 Penny-weight.

4*thly*, The Globe filled with Steam, as before; only now I continued the Globe longer with the Steam paſſing through it, by which it acquired a greater Degree of Heat; for I found by thoſe Experiments, that the leaſt Degree of Cold leſs than the Steam, a Part would be condenſed again into Water, by which the Quantity could not be certainly attained to, that would exclude the Air out of a certain Space, which is the chief End of this Experiment. But in this Experiment I ſucceeded better; for, on weighing the Globe, when the Steam was condenſed, the Air let in, and all cold, it was as followeth; *viz.* 15 Pounds 3 Ounces 2 Penny-weights *Troy*, the Weight without the Steam being 15 Pounds 3 Ounces; ſo that the Weight of the Water condenſed from the Steam, or the Water converted into a ſtrong elaſtic Steam to fill the Space of this little Globe, is but 2 Penny-weights, or $\frac{1}{10}$ of an Ounce *Troy* of Water, by which $\frac{1}{10}$ of an Ounce *Troy* of Water fills, when converted into Steam, 925 cubical Inches of Space in a Veſſel, ſo as to exclude nearly all the Air. I repeated this Experiment ſeveral times, and found it nearly the ſame; and by immerging the Cock in Water, and opening it again, as in the firſt Experiment, I found the Weight of Water to be nearly as above, and to make about $\frac{15}{16}$ Void or *Vacuum*; ſo that 1 Ounce *Troy* of Water makes 9250 cube Inches of Steam, of equal Force with the like Number of Inches of Air; and with this Remark, that the Weight of the Steam is much leſs than the Weight of common Air; for in this Globe I found the Air to weigh $\frac{1}{2}$ Ounce *Avoirdupois* or 9 Penny-weight *Troy*; and the Steam, which filled the ſame Space, to weigh but 2 Penny-weight *Troy*, which is but little more than $\frac{1}{5}$th Part, and ſhews how very ſmall the Particles of Water are when ſo divided by the Force of Fire, and of what Force: From which I ſhall conclude, that 1 cubic Inch of Water will diſcharge or force out 4000 Inches of Air from a Veſſel of that Content, which I have likewiſe proved by other Experiments in working the Fire-engine: Therefore I ſhall make it my Standard in ſome future Calculations for Practice, about that noble Machine.

*5thly*, I proceeded, as before, with Steam in the Globe A; and condenſed it, as in the third Experiment; and then tried the Preſſure of the Atmoſphere on the Clack or Valve D, and ſound it required about 10 ℔ *Troy*, to lift the Clack from its Tube of 1 Inch Diameter; but in this I was not exact with ſmall Weights.

*6thly*, I excluded the Air with the Steam, and in Place of the Clack I ſcrewed on very tight a Plate, on which I placed a glaſs Receiver, as uſual, with the Air-pump; and then, turning the Cock, the Air under the glaſs Receiver expanded itſelf into the Globe, by which I had equally a Share of the *Vacuum* partly made in the Globe, and could thereby make many Experiments that are made with the Air-pump, &c. which I mention only, that ſome curious Gentlemen may hereafter make ſome further Obſervations by the like Experiments.

## *Obſervations from Experiments made by* J. Payne.

1. THAT a Pot or Veſſel, of the Size and Shape here mentioned, will (being kept to a dark-red Heat, and the Water regularly diſperſed) rarefy or expand 50 Gallons of Water, Wine Meaſure, *per* Hour.

2. That a cube Inch of Water will make in Practice 4000 Inches of Steam; or that the elaſtic Steam of one cube Inch of Water is ſufficient to exclude the Air out of a Veſſel that is in Content 4000 Inches.

3. That the above 50 Gallons will produce 46,000,000 cube Inches of elaſtic Steam *per* Hour, which is *per* Minute 770,000.

4. That the ſecond Pot or Veſſel, as in the Draught TAB. VI. Fig. 2. will rarefy or expand 40 Gallons of Water, Wine Meaſure, *per* Hour, and will produce 36,960,000 cube Inches of elaſtic Steam *per* Hour, which is *per* Minute 616,000 Inches.

5. That both being united together make 1,386,000 cube Inches of Steam every Minute, from 346 Inches of Water.

6. That, by an Experiment made at a Fire-engine, 40 Gallons of Water *per* Hour, made into elaſtic Steam in this Method, will effectually give Motion to a 24 Inch Cylinder *Fire-engine*.

7. That, by true Experiments made at *Wedgbury* and *Newcaſtle on Tyne*, One hundred Weight, containing 112 ℔ of Pit-coals, will, and is ſufficient in this Method to expand or rarefy 90 Gallons of Water *per* Hour into an elaſtic Steam or Vapour.

8. That, by the beſt Accounts and Obſervations I could get and make, they conſume under their Boilers to make the ſame Quantity of Steam, Three hundred Weight of Pit-coal, at 112 ℔ to the Hundred, in working a Fire-engine one Hour.

9. That 95 Gallons of Water *per* Hour, expanded or rarefied into Steam, will work a 30 Inch Cylinder Engine.

10. From theſe Obſervations I conclude, that this new Invention will ſave at leaſt 90 *per Cent.* in Pit-coals, to work a Fire-engine.

## TAB. VI. Fig 1.

A, A, *The Two Pots.*
B, B, *The Two Copper Heads or Globes.*

C, C, *The Two ſinking Pipes, for waſte Water, that is not evaporated.*

D, D, *Clacks or Valves, to keep out the Air.*

E, E. *The Two Diſperſers and Spouts.*

F, F, *The Stools with a Centre-pin, on which the Diſperſer reſteth.*

G, G, *The Two Iron Pipes, in which the Water is conveyed to the Ciſtern.*

H, *A Ciſtern of hot Water.*

I, I, *Two Cog-wheels, to turn the Diſperſer.*

K, *A Steam-pipe, in which is conveyed the Steam to the Cylinder.*

L, *The Cylinder of the Fire-engine.*

M, M, *Leaden Pipes, that convey hot Water from the Ciſtern to the Diſperſer.*

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## XX. *An Examination of* Weſtaſhton *Well-waters, belonging to* Tho. Beach, *Eſq; a Well about Four Miles from that of* Holt; *by* Ambroſe Godfrey Hankewitz.

*Obſ.* 1. I Took four Ounces of the *Weſtaſhton* Water, with as much Milk, and ſet them on the Fire; as ſoon as they boiled, the Milk began to curdle, which denotes a brackiſh Salt of a neuter Nature. The Water changes Syrup of Violets green.

*Obſ.* 2. Some Powder of Galls infuſed in this Water, gives it a Tinge of a brown Purple; by which it appears, that this Water is Chalybeat: For all Martial Waters will, with Galls, turn blackiſh or inky.

*Obſ.* 3. A fixt *Alcali*, as *Ol. Tartar. per deliq.* and a volatile one, as *Sp. Sal. Armoniaci*, cauſed a white Precipitation, which denotes an aluminous cretaceous Earth.

*Obſ.* 4. A Solution of Salt of Lead, cauſes a Cream-like, or a troubled milky Colour.

*Obſ.* 5. The uſual acid Spirits, *viz.* Spirit of Salt, Nitre, and Vitriol, cauſe no Alteration; which ſhews that the Water is itſelf impregnated with an Acid.

*Obſ.* 6. The Water, being evaporated to a Pellicule, depoſits ſaline Cryſtals of a rough or auſtere Taſte, being of a ſtyptic Nature; and ſeparates a Martial yellowiſh Okre (which is attracted by the Loadſtone), and is an Abſorbent, for it ferments with Acids. The remaining Brine, being evaporated to Dryneſs, leaves a Salt of a lixivious alcaline Taſte.

*Obſ.* 7. Some of theſe Salts being put into Water, Three Parts out of Four diſſolve very readily; but One fourth Part will not diſſolve at all, but is of a Talcky Nature, and unalterable in the Fire.

Hence we may obſerve, that Chalybeat Waters, as long as they retain their natural ſulphureous *Gas* are capable of keeping ſuſpended, or floating in them, theſe Talcky Suſtances; but that Boiling drives away that ſulphureous *Gas*, upon which this Talcky Subſtance ſubſides, and cannot again be diſſolved in Water, and remains fixt againſt the Power of the Fire; for it ſuffers no Alteration upon a red-hot Iron, neither emitting Flame, nor melting, as neither doth Talck itſelf.

*Obſ.* 8. Theſe Chalybeat-waters contain ſomewhat of the ſame Nature as our Cathartic *Epſom ſalt*, only not ſo mild upon the Tongue; for by this Examen, when their *Gas* is gone, they are found to contain two Sorts of ſuch like Earths: the one abſorbent, fermenting with Acids; and the other fixt, or Talcky: And that this Subſtance is really Talcky, is confirmed by the digging up of a pretty deal of Talc in the ſinking this Well.

All the Salts of the medical Waters are more generally alcaline than acid, being of a Martial Nature, impregnated with Sulphur, which gives them a muriatic Taſte.

We may hence conclude, that this *Weſtaſhton* Water is a very good Chalybeat Water; and, by Report more plentiful and more conſtant all the Year round, than the Well at *Holt*, which Spring diminiſhes much at a certain time of the Year; but both ſeem alike for their Virtues, and phyſical Uſe, being both alike Martial.

## XXI. *An Examination of the* Chiltenham *Mineral Water, by* Conradus-Hieronymus Senckenberg; *which may ſerve as a* Method *in* general *for examining* Mineral Waters.

THE Water is bright and clear to the Sight, of no Smell, yet of a bitter Taſte.

To know its conſtituent Parts, the following Experiments were made; and, firſt, to try whether there is any *alcaline Salt* in it.

*Rheniſh Wine* was mixt with the Mineral Water. *Rheniſh Wine* is a ſubtilized *Acidum eſſentiale* in a ſpirituous and oily Liquor: Wherefore an *alcaline Salt* ſhould have been manifeſted; but it was unaltered.

Diſtilled Vinegar is a ſtronger vegetable Acid; but, mixt with the Water, procures no Alteration.

*Spiritus Salis, Nitri,* and *Vitrioli,* the three ſtrongeſt and pureſt mineral Acids, being mixt with the Mineral Water, there was no Change or Precipitation.

*Mercurius ſublimatus corroſivus,* is a Diſſolution of Quickſilver in concentred Spirit of Salt, which, being diſſolved in common diſtilled Water, manifeſted not only the volatile, but alſo the fixed alcaline Salt, in any Liquor, inſomuch that it precipitates the *Volatiles* to a *white,* and the *fixed* alcaline Salts to a *red* Powder; but, mixt with this Water, produced no Precipitation.

*Vitriolum Martis* is an acid Salt, intimately mixt with Iron-earth: Being diſſolved, and put into another Liquor, it will preſently betray the alcaline Salts by precipitating them; but ſhould it find no contrary Salt, then ſomewhat of the Iron-earth will ſettle to the Bottom; as is common in diſſolving all ſorts of *Copperas:* And ſo it happened by mixing this Mineral Water with it, when a brown Powder ſettled, which is the *Terra Martialis.*

All theſe Experiments ſhew evidently, that no *alcaline Salt* is in the ſaid Mineral Water.

For, to try whether there is any acid Salt to be found in this Water, the following Mixtures were made:

*Aqua Calcis Vivæ,* which contains an Earth impregnated with *alcaline Salt,* makes a very quick Diſcovery of an *Acid,* by Precipitation; but, mixt with this Water, cauſed no Variation.

*Syrupus Violarum,* having a very ſenſible vegetable Tincture, which, by mixing it with a ſmall Quantity of any *Acid*, turns *red*, and, with an *alcaline* Salt, *green*; but, mixt with this Water, keeps its Colour.

*Oleum Tartari per Deliquium*, which is an *alcaline* Salt, diſſolved in Water: And,

*Spiritus Salis Armoniaci*, a volatile *alcaline* Salt in Water, they being mixt with this Mineral Water, the Mixture grew milky, and a little after a white Precipitate ſettled. This happens when a fixed or a volatile alcaline Salt meets with a neutral Salt; then they join together, and ſomewhat of the alcaline Earth falls down.

*Milk* mixt with a Mineral Water, and boiled in equal Proportion, will make a Separation, by meeting with either an *acid* or *alcaline* Salt in it, or, by finding of the laſt Salt, the Mixture will change red; but our Mineral Water may be boiled with it in ſeveral Proportions, without any Change or Precipitation.

According to theſe Experiments, there is no *acid Salt* in this Water.

To ſee whether there is no *Iron* or *Copperas* in it,

If the *Solution* of *Galls* is mixt with any Liquor, and grows black, then it is a Sign of *Iron* or *Copperas*; but our Mineral Water, mixt with it, turned a little browniſh, becauſe of the Salt in the Water.

To know whether there is any *Brimſtone* in a Mineral Water, it is to be inquired with a poliſhed Piece of Silver, which, being put in the Water, will turn black or yellowiſh; but this did not happen with this Water.

To find out the *acidum ſalinum* in a Mineral Water, you muſt mix with it *Solutio Argenti*, which turns inſtantly *white*, and a light Precipitate falls, being the *Luna Cornea*.

A

A Solution of *Saccharum Saturni*, mixt with the Water, yields the *Magiſterium Saturni*.

All the above-mentioned Experiments certify, that our Mineral Water contains no *alcaline* nor *acid Salt*, no *Iron*, *Copperas*, or *Brimſtone*: Therefore from the ſame Experiments it is evident, that the *Chiltenham* Water conſiſts of a *Sal medium fixum vel neutrum*, and a diſſolvable *Terra alcalina vel cretacea*, which may be ſeparated.

By a *Sal medium*, is to be underſtood, a Salt being neither of an *alcaline* nor an *acid* Nature; and that will not precipitate any Solution made with ſuch Salts, nor, mixt with the Syrup of Violets, will change its Colour.

Theſe neutral Salts have always their Origin from an *alcaline* and an *acid Salt*; and, according to the *alcaline Salt* they meet with, ſo they are qualified. So we have the *Tartarus vitriolatus*, conſiſting of the *Sal alcali fixum*, and *Acidum vitriolicum*.

The *Arcanum duplicatum* of the *Sal alcali*, Saltpetre, and *Acidum vitriolicum*.

The *Sal Mirabile* GLAUBERI, conſiſting of common Salt, and its *Terra fluxilis*, and an *Acidum vitriolicum*; but with this Difference, that the *Sal Mirabile* will ſoon melt in a Crucible with a gentle Fire; but *Tartarus vitriolatus*, *Arcanum duplicatum*, *&c.* will not melt, even with the ſtrongeſt Heat, becauſe of the Difference of the Earth in the alcaline Salt, which in the common alcaline Salt is very fixt, but in the common Salt very volatile and fuſible.

Such a *Sal medium* as the *Sal mirabile*, we find in this Mineral Water, yet mixt with ſome common Salt.

As for the Bitterneſs of this Water, there is no other Reaſon for it than the *Terra Cretacea*, which is proved by the *Epſom* Salt, where the *Terra alcalina Salis communis*, joined with the *Acidum vitriolicum*; and after the ſame manner in the *Sal mirabile*, the alcaline Earth cauſes the bitter Taſte. The ſame may alſo be found, by mixing Quick-lime with Spirit of Vitriol, and it will produce a very bitter Taſte; but the Mixture of Quick-lime with Spirit of Nitre cauſes a Bitterneſs which exceeds Gall.

One Pound *Troy* of this Water yields 29 Grains of the ſaid *Sal medium*, and 3 Grains of the Earth.

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## *Remarks by* C. M.

The Right Honourable the Lord *Cadogan* had communicated a ſhort Account of theſe Waters to the *Royal Society* on *April* 17. 1735 being a Letter his *Lordſhip* had received from Mr. *Tho. Dundaſs*, Surgeon to his Lordſhip's Regiment, dated at *Glouceſter*, *March* 25. 1735. wherein he gives an Account of ſome few Experiments he had made on theſe Waters, which mostly agree with the preceding ones; *viz.* that there were no Minerals of a Chalybeat Nature in them; nor any Signs of *Nitre* or *Sulphur*: But that ſix Quarts of this Water being diſtilled very carefully, the Sediment at the Bottom of the Veſſel was nothing more than *Alum* and *Sal Gem*, to which it owes its *purgative Quality*. Some of the Salt of this Water, being put into a Solution of Silver, quickly made a Precipitation of the Silver. Mr *Dundaſs* ſays, that ſome alcaline Liquors, as *Oil of Tartar*, Spirit of *Sal Ammoniac*, &c. being dropt into ſome of the Water, immediately produced a violent Effervescence; which plainly ſhews a great *Acidity*; which he aſcribes to the *Alum* in this Water. M. *Senckenberg* found no ſuch Effervescence on mixing theſe two alcaline Liquors with the Water; but only ſays it grew milky, and a little white Precipitate ſubſided. I can account for this material Difference no otherwiſe, than by ſuppoſing, that the *Acid*, which cauſed the Effervescence in Mr. *Dundaſs*'s Experiment, was a volatile *Gas*, which was not quite ſpent in being carried no farther than *Glouceſter*, but which was quite evaporated and flown away before the Water came into M. *Senckenberg*'s Hands in *London*: And as to the *Alum*, M. *Senckenberg* did not attend to it.

"Mr. *Dundaſs* thinks theſe Waters may be of Uſe in a lax Conſti-
"tution, when the Humours are of an *alcaleſcent* Nature; but, when
"*aceſcent*, muſt do Hurt."

XXII. *An*

# XXII. *An Account of a new* Purging Spring *diſcovered at* Dulwich *in* Surrey, *by Mr.* John Martyn, F. R. S. Prof. Botan. Cantab.

*DUlwich* is a Village lying about Six Miles South of *London*, at the Foot of that Ridge of Hills which divides the Counties of *Kent* and *Surrey*. The Purging Springs, which have been eſteemed for about a hundred Years, and are commonly known by the Name of *Dulwich Waters*, have been improperly ſo called; thoſe Springs ariſing in a Valley on the South Side of thoſe Hills, in the Middle of a large Common belonging to the Pariſh of *Lewiſham* in *Kent*; whereas *Dulwich* is on the North Side of the Hills, in the Pariſh of *Camberwell* in *Surrey*.

There has not been any medicinal Spring obſerved in *Dulwich*, before that which is the Occaſion of this Diſcourſe.

In the Autumn of 1739, Mr. *Cox*, the Maſter of a well-known Houſe of good Entertainment, called the *Green Man* at *Dulwich*, lying about a Mile beyond the Village, was deſirous to dig a Well for the Service of his Houſe, there being no Spring of good Water near it. And as it was probable, that he would be obliged to dig pretty deep, I was willing to obſerve what *Strata* of Earth he dug through. The firſt 20 Feet in Depth ſeemed to be only the Clay, which, in a long Tract of Time, had been waſhed off from the ſteep Hill, at the Foot of which his Houſe is ſituated. It was intermixed with Pieces of Roots and Leaves, and with other Fragments of vegetable Subſtances.

ſtances. In digging 40 Feet deeper, the Clay was found of various Colours, brown, bluiſh, and black; intermixed with a conſiderable Number of *Pyritæ* or Copperas Stones, and ſome pretty large Maſſes of the Waxen vein or *Ludus Helmontii*, which is alſo found in great Plenty on the Sea-ſhore near the Spaw at *Scarborough*.

The Well being digged to the Depth of [illegible] Feet, and no Water appearing, Mr. *Cox* cauſed it to be covered up, and gave himſelf no farther Trouble about it that Winter. The following Spring, on my coming down, it was opened. I found [illegible] Feet of Water, of a ſulphureous Smell and Taſte, which went off, after the Well had been opened ſome Days.

As I had a ſtrong Suſpicion, that this Water was impregnated with ſome Mineral, I made an Inquiry into the Nature of it by the following Experiments:

1. It curdled Milk.

2. It became green, when mixed with Syrup of Violets, which Colour diſappeared in a few Days.

3. Being poured on Green Tea, it did not acquire any Colour.

4. Being mixed with powdered Galls, it acquired a deeper brown Colour than Rain-water did, and continued turbid; whereas the Rain-water continued clear, after the Galls were ſubſided.

5. Being ſhaken in a cloſe-ſtopped Phial, it diſploded a Vapour on opening the Phial before the Commotion ceaſed, with a more audible Noiſe than common Water did.

6. Being mixed with Oil of Vitriol, and Oil of Tartar, a much more conſiderable Ebullition was

raiſed, than by the Mixture of thoſe Liquors with Rain-water.

7. Six Quarts of this Water, being boiled to a Pint, let fall a large Quantity of a fine, whitiſh, inſipid Powder; and the Water ſo boiled had a very ſtrong ſaline Taſte, with a Mixture of Bitterneſs, not unlike the *Sal catharticum amarum*.

8. It let fall a copious white Sediment, on the Addition of the Oil of Tartar, which has the ſame Effect on a Solution of Alum, or of *Sal catharticum amarum*.

9. The boiled Water, after it had depoſited its Earth, precipitated large white Flakes, on the Addition of Oil of Tartar.

10. It differs from a Solution of common Salt. For the Oil of Tartar, being dropped into that Solution, cauſed only a ſlight Precipitation, which was ſoon afterwards abſorbed again by the Water.

11. It does not lather with Soap.

Having made theſe Experiments, I was ſatisfied, that this new Spring was really a Purging Water, as it has ſince been found by Experience. Some of Mr. *Cox*'s Family drank of it with Succeſs, which encouraged ſeveral other Perſons to try it, to their great Advantage.

Being drank freſh, in the Quantity of Five half pint Glaſſes, it purges quickly, not ſinking, but raiſing the Spirits.

It is found to be very diuretic.

Theſe Properties of the *Dulwich Water* do not ſeem to be owing to any of the Materials found in digging the Well. The *Pyritæ* are known to be a Mixture of Iron and Sulphur; but this Water ſeems to have hardly any Parts of Iron in it [Exp. 3. and 4.]. The Spirit, with which it abounds, [Exp. 5. and 6.] may, perhaps, be owing to a Fermentation of the Sulphur, which is continually flying off, as appears by the ſtrong Smell of it, after it has been for ſome time covered up. And Mr. *Cox* has lately informed me, that a ſilver Cup, which has been often uſed in drinking this Water, has acquired a yellowiſh Colour.

The *Ludus Helmontii* affords nothing but Iron. Nor does the Clay, through which they dug, diſcover any Salt in its Compoſition. We may therefore conclude, that the Hill, which lies between the old Wells and this new one, contains the Purging Salt, with which theſe Waters are impregnated.

I do not find any material Difference between the old and new Waters, except in the Convenience of drinking them. The old Wells are at a Diſtance from any Houſe, except ſome few Huts, and expoſed to the Rain and Land-floods, by which they are often injured; The new Well is a Mile or two nearer to *London*, well ſecured from any Injuries of the Weather.

*December* 11. 1740.

John Martyn.

# XXIII. *An Obſervation of the* Lights *ſeen in the* Air, *an* Aurora Auſtralis, *on* March 18. 1738-9. *at* London, *by* Cromwell Mortimer, *M. D. Secr. to the* ROYAL SOCIETY.

ON *Sunday* Evening, *March* 18. 1738-9. about half an Hour paſt Seven, the Sky to the North was very clear, and the Stars ſhone bright; to the South and South-eaſt, as I was in the Skirt of the Town on the North-weſt Side, the Sky looked obſcured, partly from a Miſt, partly from the Smoak of the City. At the ſame time there appeared a bright Column ariſing ſomewhat North of the Eaſt, or about the Eaſt North-eaſt, which reached up with its Point near to the *Zenith*, but going a little South of it. This Column ſeemed to be the Boundary of the clear and obſcure Regions of the Sky abovementioned: It had an uniform ſteddy Light, without any Dartings or Shiverings; but it ſometimes vaniſhed for a few Minutes, and then returned again all at once, not proceeding from the Bottom, but from the Side next the miſty Part of the Sky, as if it were only the Border of the Miſt illuminated. About Eight this Column was grown much wider, and all of a Breadth, extending in the ſame Direction beyond the *Zenith* to the Weſt South-weſt, as far as I could ſee for the Houſes; the Addition to its Breadth ſeemed to be all on the Southern Edge of it; this whole Band was of a moſt beautiful Pink colour. A quarter after Eight, the *Phænomena* remained the ſame; but to the North North-weſt there appeared ſome whitiſh Clouds about [illegible] from the *Zenith*. Out of this aroſe three large Pyramids of Light, which extended very near the *Zenith*; the middle of theſe Pyramids were of a beautiful Sea-green, which went off gradually in lighter Shades towards the Edges, which were of a bright White: The Colour of theſe very much reſembled the Light of *Phoſphorus*. I obſerved theſe Columns for ſome Minutes, and then going in a-doors, ſaw no more of the Phænomenon; and was told, half an Hour after, that it was all over, but have been informed ſince, that it returned again about Ten; when the Redneſs ſpread, almoſt univerſally, over the Southern Parts of the Heavens.

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## XXIV. *A Letter from Mr.* John Martyn, F.R.S. Prof. Botan. Cantab. *to* John Machin, *Eſq;* Secr. R. S. *and* Prof. Aſtron. Greſham. *concerning an* Aurora Auſtralis, *ſeen* March 18. 1738-9. *at* Chelſea, *near* London.

*SIR*,

I Now trouble you with a rude Account of the *Aurora Auſtralis*, or what other Name you chuſe to call it by, which was mentioned at the Society laſt *Thurſday*.

*Sunday, March* 18. 1738-9. at half an Hour paſt Eight, being informed, That there was a great Fire towards *London*, I made haſte towards an upper Window that looked to the North North-eaſt; I found an extraordinary Redneſs in the Air, but of too determined a Figure to ariſe from the burning of a Houſe: A broad red Band extended itſelf to the Northward of the Eaſt; in the Middle of which I very plainly ſaw *Arcturus*, then about 25° high; and its Northern Edge touched *Cor Caroli*. It ſeemed to be fixed and permanent; not radiating, or fading, as in a common *Aurora Borealis*. This red Band, or Arch, was bounded on the North by Streams of a greeniſh Blue, in the ſame Direction; the moſt Northern Edge of which touched the Star marked η in the Tip of the Tail of *Urſa Major*. After I had conſidered this Phænomenon for ſome little time, I retired into my Garden, where I ſaw a great Brightneſs almoſt in the Zenith, but declining to the South-weſt; which I found to be a Centre, from which many luminous *Radii*, of which the red Band was much the moſt conſiderable, proceeded. This Crown, or Centre, ſeemed, at that time, as near as I could judge, about the Place of *Cancer*; for it effaced all the neighbouring Stars, and I could but juſt ſee two Stars, which I take to be thoſe in the Heads of the *Twins*; when the Brightneſs was moſt faded: It would ſometimes almoſt diſappear for near a Minute, and then kindle again, and dart Rays on all Sides; but thoſe to the Weſt and North were ſhort, pale, and ſoon diſappeared. Thoſe which ſhot Southward, were of a firy Red; and the whole Southern Part of the Atmoſphere was tinged with a red Brightneſs, which did not however reach quite down to the Horizon; for, to the South-weſt, where my Proſpect was leaſt confined, I could ſee *Sirius*, then about 15° high beyond the red Light. The Houſes oppoſite to mine hindered me from ſeeing, how far to the Eaſt and North-eaſt the red and blue Rays extended. All this while, the North and North-weſt Parts of the Heavens ſeemed dark, by reaſon of the great Brightneſs in the Eaſt and South: It was very clear however, and the Stars viſible. About Nine, the red Band had covered the Tail of *Urſa major*, having moved conſiderably towards the North, the Centre continuing in the ſame Place; and by degrees it faded ſo as not to be diſtinguiſhable from the common Redneſs which was ſpread over ſo conſiderable a Part of the Heavens. About Ten I went to the River-ſide, where I had a large Proſpect to the Southeaſt; and found all that Part covered with a duſky Red, quite down to the Horizon. There were afterwards ſome faint Rays darted, ſometimes from the Centre of this Phænomenon, which has the Appearance of a common *Aurora Borealis*. If you can gather any thing material from this Deſcription, it will be a Pleaſure to,

*SIR,*

*Your moſt obedient*

*humble Servant,*

John Martyn.

## XXV. *Part of a Letter from the Reverend Mr.* Timothy Neve, *Secretary of the* Gentlemens Society *at* Peterborough, *to Dr.* Mortimer, *Member of the ſame* Society, *and Secr.* R. S. *concerning the ſame* Aurora Auſtralis.

* * * * *

WE had, on *Sunday* Night laſt, *March* 18. from about half an Hour after Seven, till almoſt Nine o'Clock, an *Aurora Auſtralis*, which ſpread with Variety of Colours all over the Horizon, meeting in a Centre almoſt vertical, but ſomewhat inclining to the South. The original Colours were ſo mixed and blended in the common Centre, as, by the vaſt Variety eaſily diſtinguiſhed, made a beautiful Appearance. The fainter Colours came from the two oppoſite Points of the North-weſt and South-eaſt: The Blood-red Crimſon, *&c.* were ſeen chiefly in the North eaſt and South-weſt. The Wind, I think, full North; but very ſtill. The three preceding Days, *Thurſday*, *Friday*, and *Saturday*, were exceſſive cold; the Barometer fell Eight or Nine Degrees, and we had very great Quantities of Snow, Hail, and Rain, moſt of that Time; and, if I remember right, the Lights in the Air, of late Years, appear after ſuch Storms, eſpecially for Ten Years paſt, when our Winters have been unſeaſonably mild, and our Summers cold and rainy. I am, Sir,

*Your moſt obedient*
*humble Servant*,

Tim. Neve.

XXVI.

# XXVI. *A Deſcription of a* Catheter, *made to remedy the Inconveniencies which occaſioned the leaving off the* High Operation *for the* Stone; *by* Archibald Cleland, *Surgeon to General* Wade's *Regiment of* Horſe.

AS this Operation was left off very precipitately, in order to introduce that Method now called the *Lateral Operation*, which has been practiſed for ſome time with good Succeſs; notwithſtanding, had the Operators at that time had the Advantage of this Inſtrument I here offer to this Honourable SOCIETY, I am perſuaded the Advantage would have been more than equal in favour of this *High Operation*, and preferable to any other Method yet practiſed: And I humbly hope, that the Deſcription, and the Method of uſing this *Catheter*, will be a means of reviving an Operation ſo happily begun, and calculated for the Good of thoſe that are afflicted with the Stone in the Bladder.

This *Catheter* is made either of Silver or Steel, of different Sizes, to ſuit different Ages; and has the outward Appearance of a common *Catheter* (TAB. VII. *Fig.* 1.), and will anſwer the ſame Uſes: But, in reſpect to this Operation, it differs from the common in this, that it is compoſed of Two Legs (*Fig.* 2.), with blunt Points, a long Tube, a Sliding-bolt, and a Handle, which ſerves to open and ſhut the Legs: The Bolt, which is fixed to the Extremity of the Tube, goes into Two Holes, fixed in the Plate of the Handle: The one ſerves to keep the Legs cloſe during the time it is to be introduced into the Bladder, the other to extend the Points at the Diſtance of an Inch or more, during the time the Operation is performing.

The Method of uſing this *Catheter* is, firſt, (after having taken the neceſſary Precautions, and filled the Bladder) to introduce the *Catheter* into the Bladder, then unbolt it at the Handle, and by holding the Tube in one Hand, and the Handle that moves the Legs in the other, then turn or open the Legs, till the Bolt becomes oppoſite to the Second Hole upon the Plate into which the Bolt muſt be thruſt; then by preſſing gently the Handle downwards betwixt the Patient's Legs, the Two blunt Points will be eaſily felt above the *Os Pubis*, in the Protuberance made by the Injection into the Bladder.

The Advantages I propoſe by uſing this Inſtrument, are theſe: Firſt, To be a Director for the Operator, in determining the Place where the Puncture is to be made in the Bladder; it alſo ſerves as a Support to the Bladder, when the Water flows out; and keeps it from ſubſiding during the Time of the Operation, and till the Stone is extracted: It ſerves likewiſe to reſiſt the Preſſure of the abdominal Muſcles and *Peritoneum*, and alſo hinders the *Inteſtines* from being forced down upon the Knife; and keeps the Orifice open, till the Stone or Stones are brought away. And, laſtly, by the Help of this Inſtrument it may be diſcovered, whether the Bladder is indurated or ſcirrhous.

The Method of performing this Operation, with Safety, is, after having introduced and fixed the *Catheter* with its Legs open, to feel for the Two Points

above

above the *Os Pubis*, and place the Finger and Thumb gently upon them; then give the Handle to an Aſſiſtant, to keep it firm in that Poſition; then, with the Knife in the Right Hand, make a Puncture at once into the Bladder, exactly in the Middle betwixt the Points; but, for the more Security, ſomewhat lower nearer the *Os Pubis*; and, without drawing out the Knife, make a large Inciſion downwards, inclining under the Arch of the *Pubis*, in proportion to the Bigneſs of the Stone, taking care not to wound the Cartilage that joins the Bones together, when the Knife is withdrawn: The Bladder being thus ſupported, the Stone may be extracted with the Fingers, or with a ſmall Pair of Tenets, there being little Danger of breaking it in this Method. When the Operation is finiſhed, raiſe the Handle of the *Catheter*, and unbolt it; ſhut it cloſe and fix it ſo; then withdraw the *Catheter*, and dreſs the Patient.

*April* 5. 1739.

*See* TAB. VII.

Fig. 1. *The* Catheter, *as it is to be introduced into the Bladder, the Two Legs* A *and* B *being cloſed together.*

Fig. 2. *The* Catheter, *its Two Legs* A, B, *being open.*

C, D, *The Tube.*

F, *The Sliding bolt.*

F, *The Two Holes into which the Bolt is to be ſlid.*

G, *The Ears fixt to the Tube* C, D, *which is all of one Piece with the Leg* A.

H, *The Handle, which opens the Legs; this Handle is all of one Piece with the*

*the Leg* B, *which Leg* B *is a Continuation of a Wire, that runs through the Tube* C D, *and is faſtened to the Handle* H, *and turns with it.*

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## XXVII. *A* Deſcription *of* Needles *made for Operations on the* Eyes, *and of ſome* Inſtruments *for the* Ears, *by the Same.*

THE firſt differs from a common Couching-needle, [TAB. VII. *Fig.* 3.] in this, that it is made of Two Pieces of Steel ſoldered together, and fixed in a Handle [*Fig.* 4.]: At a little Diſtance from the Handle they ſeparate, and have, in each *Lamina*, a Button fixed, which paſſes through a Hole in the other; from this Part to the Points, they are ſo nicely applied, and poliſhed together, that they cut, and have the Shape of a common Needle: Upon preſſing the Buttons, the Points are ſeparated, and in the Inſide of the broad Part of the Points are ſeveral ſmall Indents, to prevent any thing from ſlipping, after it has once got hold.

The Uſe of this Needle is, either to depreſs a Cataract; or, if it ſhould be found of ſuch a Nature as to bear to be taken hold of, then, by opening the Points, to engage it, and carefully bring it out of the Eye.

If it ſhould happen, that in depreſſing the Cataract, or in bringing it out of the Eye, ſome of the ſmall Veſſels are wounded, and ſome Drops of Blood diffuſe themſelves in the aqueous Humour; this ſecond Needle [*Fig.* 5.] is made with Deſign to remedy this Inconveniency.

It is a long, ſmall, round Stilet [*Fig.* 6.], gradually decreaſing from the Handle to the Point; and is fitted to a long Silver Tube of the ſame Shape [*Fig.* 7.], into which the Needle is put, and the Point comes out at the End one Quarter of an Inch. This is to be introduced into the Eye at the Orifice the other Needle had made: When it is ſo far introduced, as the End of the Tube is within the poſterior Chamber of the aqueous Humour, the Needle is to be withdrawn, leaving the Tube in the Eye; and then, with the Mouth, may be ſucked into the Tube, all the Blood, and watery Humour, that is contained there, or any other floating Particles: Then the Tube is to be withdrawn, and the Eye left to repleniſh itſelf with the aqueous Humour again; which will take Twelve or Eighteen Hours at moſt.

### *The following* Inſtruments *are propoſed to remedy ſome kinds of* Deafneſs *proceeding from Obſtructions in the external and internal auditory Paſſages.*

IN order to diſcover, with more Exactneſs, whether the Diſorder lies in the outward Ear, I make uſe of a convex Glaſs, Three Inches in Diameter, fixed in a Handle, [Tab. VII. *Fig.* 8.] into which is lodged ſome Wax Candle, which comes out at a Hole near the Glaſs, and reaches to the Centre; which, when lighted, will dart the collected Rays of Light into the Bottom of the Ear, or to the Bottom of any Cavity that can be brought into a ſtrait Line. Therefore, when it is diſcovered by the Help of this Glaſs, and lighted Candle, that the Ear is full of hard Wax, which will not bear to be taken out with the *Forceps*, the Method is to have a ſmall Boiler, wherein are put ſome proper Herbs; and, by different Tubes of various Sizes, the Steam is conveyed to the Bottom of the Ear. In a ſhort time, the Wax will diſſolve, and the Perſon find great Eaſe. In one of theſe Tubes, are placed Two Valves, to regulate the Heat to the Perſon's Inclination. If this has not the deſired Effect, and the Perſon ſtill remains deaf, the following Inſtruments are made to open the *Euſtachian* Tube: If, upon Trial, it ſhould be found to be obſtructed, the Paſſage is to be lubricated by throwing a little warm Water into it by a Syringe joined to a flexible ſilver Tube, which is introduced through the Noſe into the oval Opening of the Duct at the poſterior Opening of the *Nares*, towards the Arch of the Palate. The Pipes of the Syringe are made ſmall, of Silver, to admit of bending them, as Occaſion offers; and, for the moſt part, reſemble ſmall Catheters: They are mounted with a Sheep's Ureter [*Fig.* 9.]; the other End of which is fixed to an Ivory Pipe; which is fitted to a Syringe, whereby warm Water may be injected: or they will admit to blow into the Euſtachian Tube, and ſo force the Air into the Barrel of the Ear, and dilate the Tube ſufficiently for the Diſcharge of the excrementitious Matter that may be lodged there. The Probes, [*Fig.* 10.] which are of the ſame Shape with the Pipes, have ſmall Notches near the Points, which take in ſome of the hardened and glutinous Matter, that is contained in thoſe Tubes, which is diſtinguiſhed by the fetid Smell, when the Probes are withdrawn.

There is another Kind of Deafneſs, which proceeds from a violent Clap of Thunder, Noiſe of a Cannon, or the like. In this Caſe, it is probable, that the Poſition of the *Membrana Tympani* is altered, being forced inwards upon the ſmall Bones, and ſo becomes concave outwardly. In this Caſe no Vibration of Sounds will be communicated to the Drum, until the Membrane has recovered its natural Poſition. The Means, propoſed to remedy this Diſorder, are, firſt, (if the Perſon heard very well before; and it be not too long after the Accident has happened) to oblige the Patient to ſtop his Mouth and Noſe, and force the Air through the *Euſtachian* Tube into the Barrel of the Ear, by ſeveral ſtrong Impulſes; which will, probably, puſh the Membrane back to its natural State.

But if, by any Accident, the Excrement is harden'd in the Tube, or the Orifice of it, which opens into the Barrel of the Ear, ſhould be ſtopped up, ſo as that no Air can be forced that Way, the ſecond Method propoſed, is to introduce into the *Meatus auditorius externus*, an Ivory Tube [*Fig.* 11.], as near to the Drum as can be done, and ſo exactly fitted, that no Air can go in or out, betwixt the Skin of the external *Meatus* and the Tube. When it is thus fixed, I take the further ſmall End in my Mouth, and, by degrees, draw out what Air is there contained; and, I believe, it will act like a Sucker upon the Membrane, and draw it back to its natural State; and then the Perſon will hear as before. If this ſhould fail, I ſhould be apt to believe the violent Shock this Membrane has ſuffered, may have diſlocated ſome of the ſmall Bones; in which Caſe there is ſcarcely any Remedy. And for the Diſeaſes that are called *Nervous*, I muſt leave them to the learned Gentlemen of the Faculty,

In this Ivory Tube may be fixed a Braſs Cock [*Fig.* 12.], which, being turned, will hinder the ruſhing in of the Air, while the Perſon who ſucks, takes Breath, and can renew his Suction.

The flexible ſilver Tube, for injecting the *Euſtachian* Tube, may be uſed without the Sheep's Ureter, by being ſcrewed on to a ſmall ſilver Syringe, as at *Fig.* 13.

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## XXVIII. *Part of a Letter from Mr.* Stephen Fuller, *Fellow of* Trinity College, Cambridge, *to his Father* John Fuller, *Eſq*; *ſenior*, F. R. S. *concerning a violent* Hurricane *in* Huntingtonſhire, Sept. 8. 1741. *Communicated by Sir* Hans Sloane, *Bart. late* Pr. R. S.

*Cambridge, Sept.* 9. 1741.

YEſterday was the moſt violent Hurricane of Wind in theſe Parts, that ever was known ſince the Memory of Man. *Cambridge* was not in the midſt of the Hurricane, ſo that it has eſcaped very well. I happened to be paying a Viſit to Dr. *Knight*, a Cotemporary of yours, of our College, who lives at *Bluntſham* in *Huntingtonſhire*, about 10 Miles North-weſt of *Cambridge*. We were in the midſt of the Hurricane; but, by getting into the ſtrongeſt Part of the Houſe, we eſcaped without any great Danger. The Morning, till half an Hour after Eleven, was ſtill, with very hard Showers of Rain: At half an Hour after Eleven it began to clear up in the South, with a briſk Air, ſo that we expected a fine Afternoon: The South-weſt cleared up too, and the Sun ſhining warm drew us out into the Garden. We had not been out above 10 Minutes, before we ſaw the Storm coming from the South-weſt: It ſeemed not to be 30 Yards high from the Ground, bringing along with it a Miſt, which rolled along with ſuch incredible Swiftneſs, that as near as we could gueſs, it ran a Mile and an half in half a Minute: It began exactly at 12 o'Clock, and laſted about 14 Minutes, Eight Minutes in full Violence: It preſently unheal'd the Houſe we were in, and ſome of the Tiles, falling down to Windward, were blown in at the Saſhes, and againſt the Wainſcot on the other Side of the Room; the broken Glaſs was blown all the Room over, the Chimneys all eſcaped; but the Statues, which where on the Top of the Houſe, and the Baluſtrades from one End to the other, were all blown down. The Stabling was all blown down, except Two little Stalls, where, by the greateſt Fortune in the World, ſtood my Horſe and the Doctor's. All the Barns in the Pariſh, except thoſe that were full of Corn quite up to the Top, were blown flat upon the Ground, to the Number of about 60. The Dwelling-houſes eſcaped to a Miracle; there were not above a Dozen blown down out of near 100. The Alehouſe was levelled with the Ground, but by good Luck not a Soul in it. If the Storm had laſted Five Minutes longer, almoſt every Houſe in the Town muſt have been down; for they were all, in a manner, rocked quite off from their Underpinnings. The People all left their Houſes, and carried their Children out to the

Windward Side, and laid them down upon the Ground, and laid themſelves down by them; and by that means all eſcaped, but one poor Miller, who went into his Mill to ſecure it againſt the Storm, and was blown over, and cruſhed to Death betwixt the Stones and one of the large Beams: I ſaw him taken out. All the Mills in the Country are blown down: I do not hear of any more bodily Miſchief; only one Miller at *Willingham*, ſo much bruiſed, that they hardly expect his Life. Hay-ſtacks and Corn-ſtacks are ſome quite blown away, ſome into the next Corner of the Field. The poor Pigeons, that were catched in it, were blown down upon the Ground, and daſhed to Pieces; one of which I found, myſelf, above half a Mile from either Houſe or Hedge. Where-ever it met with any boarded Houſes, it ſeemed to exert more than ordinary Violence upon them, and ſcattered the Wrecks of them for above a quarter of a Mile to the North-eaſt, in a Line: I followed one of theſe Wrecks myſelf; and, about 150 Yards from the Building, I found a Piece of a Rafter, about   Feet long, and about Six Inches by Four, ſtuck upright Two Feet deep in the Ground; and at the Diſtance of 400 Paces of my Horſe, from the ſame Building, was an Inch Board, Nine Inches broad, 14 Feet long: I am convinced, that theſe Boards were carried up into the Air; for I ſaw ſome, that were carried over a Pond above 30 Yards; and I ſaw a Row of Pales, as much as Two Men could lift, carried Two Rods from their Places, and ſet upright againſt an Apple-tree. Pales, in general, were all blown down, ſome Poſts broke off ſhort by the Ground, others torn up by the Stumps. The whole Air was full of Straw:

Gravel-ſtones, as big as the Top of my little Finger, were blown off the Ground in at the Windows; and the very Graſs was blown quite flat upon the Ground. After the Storm was over, we went out into the Town, and ſuch a miſerable Sight I never ſaw: The Havock I have deſcribed; the Women and Children crying, the Farmers all dejected; ſome bleſſing God for the Narrowneſs of their Eſcape, others wondering how ſo much Miſchief could be done with one Blaſt of Wind, which hardly laſted long enough for People to get out of their Houſes. I talked to Two People, that were out in it all the Time, who ſaid, that they heard it coming about half a Minute before they ſaw it; and that it made a Noiſe ſomething reſembling Thunder, more continued, and continually increaſing. I ſaw a Man in the Afternoon, who came from *St. Ives*, who ſays, the Spire of the Steeple, which is one of the fineſt in *England*, is blown down, as is the Spire of *Hemmingford*, the Towns having received as much Damage as *Bluntiſham*. There was neither Thunder nor Lightning with it, as there was at *Cambridge*, where it laſted above half an Hour, and conſequently was not ſo violent. Some few Booths in *Sturbridge-fair* were blown down. The Courſe of the Storm was from *Huntington* to *St. Ives*, *Erith*, between *Wiſbich* and *Downham* to *Lynn*, and ſo on to *Snettſham*: We have heard nothing of it farther to the South-weſt than *Huntington*, nor farther North-eaſt than *Downham*. Very few Trees eſcaped: The Barns that ſtood the Storm, had all their Roofs more damaged to the Leeward Side than to the Windward. We are in great Hopes the Storm was not general; I am apt to think it was much ſuch a Storm as ran through *Suſſex* about 10 Years ago. The Storm was ſucceeded by a profound Calm, which laſted about an Hour; after which the Wind continued pretty high, till 10 o'Clock at Night.

*To Sir* HANS SLOANE, *Bart.* &c.

*Honoured* SIR, *Roſehill, Sept.* 13. 1741.

THE above-written is Part of a Letter from my Son *Stephen Fuller*, Fellow of *Trinity College* in *Cambridge*; which is ſo particular an Account of a terrible Storm on *Tueſday* laſt, in *Huntingtonſhire*, in which he was preſent, as may deſerve to be communicated to the ROYAL SOCIETY, if you think fit. I am

*Your moſt dutiful Son,*
*and humble Servant,*

J. Fuller.

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## XXIX. *Extract of Letters from Mr.* T. Sympſon, *to* Brown Willis, *Eſq*; *Member of the* Society *of* Antiquaries, *and to* James Weſt, *Eſq*; *Member of the Same, and* Treaſ. R. S. *by the* Publiſher, *concerning the Remains of a* ROMAN Hypocauſtum *or* Sweating-Room, *diſcovered under-ground at* Lincoln, Anno 1739.

MR. CHANTER having ſet ſome Labourers to dig a Cellar in an Outhouſe (belonging to his Manſion) fronting the Weſt End of the *Minſter*, and ad-

adjoining to the Chequer-gate; they found Two or Three Stone Coffins, which had probably lain there ever ſince the Demolition of the antient Pariſh-church of *St. Mary Magdalen*, to make way for the Foundation of the Cathedral, and its Appendages: But going lower, about 10 or 11 Feet deep, they found ſome Building; and at 13 Feet, to their no little Surprize, they ſtruck into the Corner of a Vault. Mr. *Simpſon* took it to be a ROMAN *Hypocauſtum*: He had the Dimenſions of it taken, as in the Plan; ſee TAB. VIII. *Fig.* 1. and the Profile, *Fig.* 2.

*A.* The *Præfurnium*, [Stoking-place] Entrance or Place, where the *Fornacator* [the Stoker] ſtood to manage the Fire. It is 3 Feet 6 Inches ſquare, its Height not certainly known, becauſe of the Rubbiſh which lay at the Bottom.

*B.* The *Fornax*, Furnace, or Fire-place, built of Bricks, and arched over with the ſame. Its Length from *E* to *G*, 5 Feet 6 Inches; its Height 3 Feet at *E*, but 4 Feet at *F*, riſing gradually; 3 Feet 6 Inches long from *E* to *F*, and 2 Feet wide between *E* and *F*; 2 Feet long from *F* to *G*, and but 19 Inches wide between *F* and *G*.

*C.* The *Alveus* [or Body of the Kiln], 21 Feet 4 Inches long; 8 Feet 4 Inches broad; and 2 Feet 4 Inches high. The Floor is made of a ſtrong Cement compoſed of Lime, Sand, Brick-duſt, *&c.* which the Maſons of that Country call *Terrace mortar*. Upon this Floor ſtand Four Rows of low Pillars, made of Brick, 11 in a Row; the outſide Rows round, the Two inner Rows ſquare: The round ones are about 11 Inches Diameter, the others 8 Inches ſquare: Each ſtanding on a Brick 11 Inches ſquare, as at *Fig.* 4. and

a

2 Inches thick; the Shaft 2 Feet high, upon which lies another Brick likewiſe 2 Inches thick, ſome 17, 18, and others 19 Inches ſquare, as at *Fig.* 3. which repreſents the Profile of Two ſquare Pillars with the ſquare Bricks at Top and Bottom, which make the whole Height of the *Alveus* 2 Feet 4 Inches. The Pillars, both round and ſquare, are jointed with Mortar, and that very clumſily: The round Pillars being compoſed of 10 Courſes of ſemicircular Bricks, as at *Fig.* 4. *A*, laid by Pairs; the Joint of every Courſe croſſing that of the former at right Angles, as at *Fig.* 4. *C*; with ſo much Mortar betwixt, that the Two Semicircles rather form an Oval, and ſo the Pillars look at firſt Sight as if they were wreathed: The ſquare Pillars are compoſed of 13 Courſes of Bricks, as at *Fig.* 4. *B*; 8 Inches ſquare, as at *Fig.* 4. *D*; theſe Bricks being thinner than thoſe which compoſe the round Pillars.

On the Top of theſe Pillars reſts the *Teſtudo* or Floor of the *Sudatorium* or Sweating-Room, *Fig.* 2. *HI*, which is compoſed thus: Firſt, there is a Floor of large Bricks, 23 Inches long, and 21 broad, which lie over the ſquare Bricks on the Tops of the Pillars, as at *Fig.* 3. the Four Corners of each Brick reaching to the Centres of Four adjoining Pillars, as at *Fig.* 5. where only one of theſe larger Bricks is repreſented, as it bears upon Four of the ſmaller Bricks with their Pillars under them. On this Courſe of Bricks is a Covering of Cement 6 Inches thick, and upon that is ſet a teſſellated Pavement: The *Teſſellæ* of the Corner uncovered, *K*, in *Fig.* 1 and 2. are of a whitiſh Colour.

*L* and *M*, in *Fig.* 1 and 2. are Two *Tubuli* or Flues, 12 Inches wide and 14 deep, for carrying off the Smoke: The Bottoms of them are even with the Bottom of the *Alveus*, and they are carried upon the Level about 15 Feet, under another Room by the Side of the *Hypocauſtum*, and then it is preſumed they turn upwards. The Walls of this Room were plaiſtered, and the Plaiſter painted red, blue, and other Colours, and its Floor teſſellated white; no Figures diſcernible in either Painting or Pavement. This Pavement, which is on a Level with the *Teſtudo* of the *Hypocauſtum*, is about 13 Feet below the preſent Surface of the Ground: So deep is old *Lindum* buried in its Ruins! The Workmen, in digging up this Pavement, ſtruck into the Flue *M*, 3 Feet from the North-eaſt Corner of the *Hypocauſtum*; and opened it to the very Corner *K*, which ſhewed one of the round Pillars, and ſo the Whole was diſcovered. In ſinking the Hole *N K*, at 5 or 6 Feet Depth, they came to the Wall, which was dug up by Pieces with the Rubbiſh, before they came to the Pavement. This had been the Wall of a Room under which the *Tubuli* ran, by the Side of, and not over the *Alveus*, but on the Eaſt Side of it.

Mr. *Sympſon* got a Youth to creep in at the Opening made at *K*, and take the Dimenſions of the ſeveral Parts, who, the *Alveus* being quite black with Smoke, returned like a Chimney ſweeper; but could not take the exact Meaſures of the *Fornax* and *Præfurnium*, on account of Rubbiſh he found in them: Wherefore, Mr. *Sympſon*, being deſirous to inform himſelf thoroughly of all the Parts of this curious Piece of Antiquity, with the Leave, and at the Expence, of the

Proprietor, cauſed another Hole to be ſunk 16 Feet deep, and by driving a Level *OP*, ſee *Fig.* 1 and 2. he broke into the Middle of the *Fornax*; and, having cleared it of Rubbiſh, found its Dimenſions as above, and that the Bottom of the narroweſt Part between *F* and *G*, was raiſed 18 Inches higher than the Bottom of the Part between *E* and *F*.

The *Præfurnium* was covered over at Top with a large flat Stone.

The *Fornax*, and the Two ſquare Pillars in the *Alveus* fronting the Opening of the *Fornax*, were greatly impaired by the Fire, which muſt have been very violent: Some ſmall Fragments of Wood-coal were thrown out among the Rubbiſh in the Bottom of the *Fornax*; whence probably it was heated with Wood.

At the Concluſion of the Account Mr. *Sympſon* ſent to Mr. *Willis*, he gives us the following Remark upon a Paſſage in the ſecond Letter from Mr. *Baxter* to Dr. *Harwood*, concerning the *Hypocauſta* of the *Antients*, printed in theſe *Tranſactions*, Nº 306.

“ Mr. *Baxter* ſays, the *Hypocauſis* was called *Alveus* and *Fornax*: But, with due Deference to that learned Gentleman, (ſays Mr. *Sympſon*) I humbly apprehend them to have been diſtinct Parts of the Whole, which was called *Hypocauſis*: The Ground of my Conjecture is this: In the firſt Place, it would hardly be poſſible to make a Fire in that Part of this *Hypocauſt*, which I call the *Alveus*; much leſs to come at it, to manage it, being ſo low, and ſo crowded with Pillars, as to admit only a ſlender Perſon to crawl amongſt them, and that

“ not without Difficulty. In the next Place, the Floor does not ſeem deſigned for it, nor are there any Appearances of Aſhes on it: And, further, that the *Fornax* was, where I have placed it in this, appears not only from the Structure of that Part, but from the Bricks being much burnt [and Pieces of Wood-coal being found in it]; whereas in the *Alveus*, the Bricks are only black with the Steam and Smoak being drawn through it by the *Tubuli*. But I ſubmit my Opinion to your better Judgment.” He might have added, that only thoſe Pillars in the *Alveus*, which faced the Mouth of the *Fornax*, had ſuffered much by the Fire, the others not.

That *Hypocauſt*, deſcribed in N° 306. above-mentioned, muſt have been a much hotter Room than this; for, inſtead of the Flues being carried under another Room, the Walls of the Sweating-room itſelf were hollow or double, and a great Number of Flues carried up between them all round the Room. A curious Model of this is ſtill to be ſeen in the *Muſeum* of the ROYAL SOCIETY.

## XXV. *Accounts of a* Capricorn Beetle, *found alive in a Cavity within a ſound Piece of Wood, and of the* Horn *of a* Fiſh *ſtruck ſeveral Inches into the Side of a Ship; by* C. Mortimer, *M. D. Secr.* R. S.

ABOUT *Michaelmas* 1728. I went to *Portſmouth* with ſome Friends, where having taken a View of his MAJESTY's Yard and Docks for building Ships of War; and ſatisfied my Curioſity in examining ſeveral curious Contrivances uſed in Naval Architecture; Mr. *Bankley*, the Clerk of the Survey, invited me to his Houſe, where he ſhewed me the Inſect as repreſented in TAB. VIII. *Fig.* 6. and 7. The People of the Yard were much alarmed at it, none knowing what to make of it; and all imagining it was venomous. On opening the Piece of Wood, (which was tied together with a Packthread) I found this Animal yet alive, and moving in a large Cavity in the Middle of the Wood, which appeared otherwiſe ſound, having no viſible Entrance into it. This Beetle, being turned out upon a Sheet of Paper, crawled about upon it. Mr. *Bankley* gave me the following Account of it: "This Inſect was found *Auguſt* 26. 1728. "in ſplitting a Piece of Exotic Wood into Two "Pieces, cut acroſs the Grain 4¼ Inches thick, taken "up in the Hold of his MAJESTY's Ship *Bredah*, "when in the Dock at *Portſmouth*, after her Return "from the *Weſt-Indies*: It lived upwards of a Month "afterwards. The Hole in which it was nouriſhed,

“ was 5 Inches deep, and 2 ¾ Inches by 1 ¼ Inch
“ broad, in the great Piece; 2 Inches deep, and 2 ¼
“ Inches by 1 ¼ Inch broad, in the ſmaller Piece.
“ There was not the leaſt Sign of any Defect on the
“ Outſide of the Wood, but it appeared very fair and
“ ſound; the Inſide was porous, having a Grain like
“ *Cedar*, but in Colour not unlike yellow *Saunders*.”

On Examination, I found this Inſect to be a ſort of *Scarabæus* called *Capricornus* from its long Horns; which in this were very much crumpled, and partly broken off againſt the Wood, in its Confinement: Its Wings were likewiſe crumpled on the ſame Account. The Females of theſe Inſects uſually lay their Eggs in the Crevices of the Bark of Trees: So it is probable, that as ſoon as this Inſect was hatched in Form of a Worm, it gnawed its Way through the Bark into the Wood; and that afterwards the Hole it had made in the Wood, cloſed towards the Outſide; and the Worm, ſtill continuing to gnaw deeper, formed the large Cavity; and then taking its perfect Form of a Beetle, remained in that hollow Place, where the Sap of the Tree ariſing, might have ſupplied it with Nouriſhment, and even Air; ſince it is known, by various Experiments, that Air will inſinuate itſelf, where-ever ſuch Fluids, as contain Air in them, can penetrate.

I have ſeen in the magnificent *Muſæum* of Sir *Hans Sloane*, Bar$^{t}$. a Piece of Wood, ſound without, having a Cavity within, wherein was found alive a ſort of Beetle, but I think of a different *Species*. It came from *Jamaica*, if I remember right.

At the ſame time, that curious Gentleman Mr. *Bankley* ſhewed me the *Horn* of a *Fiſh* that had penetrated above 8 Inches into the Timber of a Ship (See

TAB. VIII. *Fig.* 8.]; and gave me the following Relation of it: “ His MAJESTY's Ship *Leopard*, having
“ been at the *Weſt-Indies*, and on the Coaſt of
“ *Guiney*, was ordered by Warrant from the Ho-
“ nourable *Navy-Board*, dated *Aug.* 18. 1725. to be
“ cleaned and refitted at *Portſmouth* for Channel-
“ Service: Purſuant thereto, ſhe was put into the
“ great Stone-dock; and, in ſtripping off her Sheath-
“ ing, the Shipwrights found ſomething that was
“ uncommon in her Bottom, about 8 Feet from her
“ Keel, juſt before the Fore-maſt; which they ſearch-
“ ing into, found the Bone or Part of the Horn of
“ a Fiſh of the Figure here deſcribed; the Outſide
“ rough, not unlike *Seal-skin*; and the End, where
“ it was broken off, ſhewed itſelf like coarſe Ivory.
“ The Fiſh is ſuppoſed to have followed the Ship,
“ when under Sail, becauſe the ſharp End of the
“ Horn pointed toward the Bow: It penetrated with
“ that Swiftneſs or Strength, that it went through
“ the Sheathing 1 Inch thick, the Plank 3 Inches
“ thick, and into the Timber 4½ Inches.”

With what prodigious Force muſt this Fiſh have moved? For had it met the Ship, the Motion of the Ship would have aſſiſted the Penetration of the Horn; but the Direction of it pointing from the Stern towards the Head, ſhews that the Fiſh ſtruck againſt the Ship, either while at Anchor; or that it overtook it, while under Sail; in which caſe the Force of the Fiſh muſt have been ſtill greater; and this was probably the Caſe, becauſe nobody in the Ship remembered the Shock. Several able Workmen on the Spot aſſured me, that, with a Hammer of a Quarter of an Hundred Weight, they could not drive in a Pin of Iron, of the ſame Form and Size, into ſuch ſort of Wood, and to the ſame Depth, in leſs than Eight or Nine Strokes.

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## XXXI. *Abſtracts of the original Papers communicated to the* ROYAL SOCIETY *by* Sigiſmond Auguſtus Frobenius, *M. D. concerning his* Spiritus Vini Æthereus: *Collected by* C. Mortimer, *M. D. Secr.* R. S.

DR. *Frobenius* being dead, and ſome learned Chemiſts at *Paris*, in *Germany*, and in *Italy*, having endeavoured, in various Manners, and with different Contrivances, to make this *Æthereal Spirit*; I thought it would be acceptable to the Curious in *England*, to give them an Abſtract of the Three Papers the Doctor communicated to the ROYAL SOCIETY concerning his *Spiritus Vini Æthereus*. The Firſt he gave in on *Feb.* 19. 1729-30. along with what is printed in N° 413. p. 283. of theſe *Tranſactions*, but was deſired by the Author not to be publiſhed at that Time. In this Paper he ſays, you muſt " take of " Oil of Vitriol, and the higheſt rectified Spirit of Wine, " equal Parts by Weight, not by Meaſure: That the " Oil of Vitriol was to be poured by little and little " into the Spirit of Wine, becauſe they will grow hot " upon mixing; that they ſhould be ſhaken often, that " they may mix thoroughly; then to be digeſted gently " in a glaſs Retort, and a large Receiver to be applied " and luted on, leſt the ſubtile Spirits ſhould fly away: " Then diſtil them in an *Athanor*, in gentle Digeſtion, " for Three Days; and pour back the diſtilled Liquor,

“ till the Liquor in the Recipient appears double, or of “ Two Sorts. Thus far he ſays, Sir *Iſaac Newton* was “ acquainted with the Proceſs *.”

He then proceeds almoſt in the very Words of the late Mr. *Godfry* [ *Hanckewitz* ] as printed in the *Tranſaction*, quoted above, p. 289.

He concludes, by telling us, that the Firſt Part of the Proceſs, till one comes to the Separation of the Two Liquors is mentioned by *Caneparius*, in his Book *de Atramentis*, firſt printed at *Venice*, and afterwards at *London*; then by the great Mr. *Boyle*; afterwards by Sir *Iſaac Newton*: That Dr. *Stahl*, and Profeſſor *Hoffmann*, were the firſt in *Germany* who knew the firſt Operation from *Kunckel*; but neither of them brought it to Perfection, or knew the Effects of it †. In *France* M. *Homberg* undertook an Experiment ſomewhat analogous to this, with Sulphur and Oil.

The Second Paper was communicated on the 12th of *February* 1740-1. in *Latin*, and contains an ample Account of the whole Proceſs, with Improvements and Additions: But as the Author in his Third Paper, given in *Feb.* 19. 1740-1. in *Engliſh*, ſays that that is the trueſt and moſt advantageous Proceſs, I ſhall preſent it to the Reader as follows, only ſubjoining the Differences and Additions in the Second Paper, by way of Note or Explication.

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* So long ago as the Time of *Raymund Lully* this Proceſs was in Uſe. See his *Epiſt. accurtatoria*, p. 327. and *Weidenfeld's* Secrets of the Adepts, *p.* 251.

† But Baron [illegible] at *Vienna*, knew the whole Proceſs; and it is ſaid *Frobenius* learned it of him.

TAKE Four Pounds in Weight of the beſt Oil of Vitriol, and as much in Weight (not Meaſure) of the beſt *Alcohol*, or the higheſt rectified Spirit of Wine.

1. Firſt, pour the *Alcohol* into a choſen glaſs Retort; then pour in, by little and little, One Ounce of Oil of Vitriol; then ſhake the Retort, till the Two Liquors are thoroughly mixt, when the Retort will begin to grow warm; then pour in more of the Spirit of Vitriol, and ſhake it again; then the Retort will become very hot. Do not pour in the Spirit of Vitriol too faſt, or too much at a time, leſt the glaſs Retort, by being heated too ſuddenly, ſhould burſt. You muſt allow about an Hour's time for pouring in the Spirit of Vitriol, not pouring in above an Ounce at a time, and always ſhaking the Retort, till the whole Quantity of the ponderous mineral Spirit is intimately united with the light inflammable vinous Spirit.

2. In the next place, examine with your Hand the Heat of the glaſs Retort, and have a Furnace ready, with the Sand in the iron Pot, heated exactly to the ſame Degree as the Retort has acquired by the Mixture of the Two Liquors: Take out ſome of the Sand, and, having placed your Retort in the Middle of the iron Pot, put in the hot Sand again round the Retort, and apply a capacious Receiver to it; ſet it into cold Water, and wrap it over with double Flannel dipped in cold Water.

Raiſe your Fire gradually *, that the Drops may fall ſo faſt, that you may count Five or Six between each, and that beſide this quick Diſcharge of the Drops, the upper Hemiſphere of your Receiver appear always filled with a white Miſt or Fumes: Continue this Heat as long as they emit the Scent of true Marjoram *.

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* Force it from the Beginning with a pretty ſtrong Fire, that not only the Spirit of Wine be carried over, but the Oil of Vitriol along with

As ſoon as the Smell changes to an Acid, ſuffocating one like that of Brimſtone, take out the Fire, and lift the Retort out of the Sand, and change the Receiver; for all that ariſes afterwards is only a mere *Gas* of Brimſtone, and of no Uſe †.

If you do not uſe the greateſt Precaution, the Liquors in the Retort will run over; the Fire muſt ceaſe, as ſoon as the æthereal Spirits are gone over; for there remains behind an *Oleum Vini*, which is extracted by the Force of the Acid out of the Spirits, which will ariſe, run over, and often cauſe Exploſions ||.

The

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with it; which will moſt certainly happen, if a middle Degree of Heat be kept up, between a reverberatory Heat and the other Degrees of Fire. For the Spirit of Wine being mixt with the vitriolic Acid in equal Weight, but by unequal Meaſure; the Spirit taking up double the Room of the Oil, does in a wonderful manner make up the Deficiency of the higheſt Degree of Heat.

* Towards the End, the Scent will more reſemble that of *Arrack*; continue this Heat for about Three Hours, till the Scent becomes offenſive, and like that of *Gas Sulphuris*.

† At this time you will ſee black Froth ariſing, which will certainly burſt your Glaſſes, and deſtroy your Work, if continued.

|| The Retort with its Receiver being removed, ſet them by in a cold Place, and when all are thoroughly cold, ſeparate the Receiver from the Retort. There will be Two different Liquors in the Receiver, which pour off through a glaſs Funnel into a glaſs Bottle, which ſtop up very carefully.

The Liquor will be of Two Sorts; that which ſwims at Top, inflammable, of the Nature τῦ Φλογιςῦ; that which ſinks to the Bottom,

like

The Second Day, when your Glaſs is cold, infuſe the Remainder, with half as much *Alcohol* *: and diſtil again as before, and you will have the ſame: The Third Day again, with as much, and proceed as at firſt, it gives it again. Go on as long as you can obtain any of the æthereal Spirit, till all turns to a *Carbo*. Then ſeparate it, and *edulcorate* it with Spirits of *Sal Armoniac* made without Spirits of Wine, till all Efferveſcence ceaſes, and diſtil it once more *e Balneo Mariæ*: So is it ready for Experiments †.

There are more Products to be got from this Proceſs: as, 1ſt, A balſamic Oil. 2dly, A *Terra foliata Tartari* of a glittering Nature, not fuſible, as is the common, prepared with Wine-vinegar, and fixt Salt, which is of great Uſe in Medicine: And, 3dly, A purple Earth out of the *Caput Mort.*

The

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like *Gas Sulphuris*, a ſulphureous Acid. Separate the one Liquor from the other, by the ſeparating Funnel *per Tritorium*.

[*] I ſuppoſe he means, pour in half as much, reckoning of *Alcohol*, as you did at firſt, that is, Two Pounds Weight, to the Liquor remaining in the Retort.

[†] *N. B.* The above mentioned Liquors are to be purified from the ſtrong-ſmelling Sulphur, and ſuperfluous Acid, which is performed in the following manner:

Pour the Liquor, which ſwims at Top, into a Phial; drop into it Drop by Drop ſucceſſively, a ſufficient Quantity of Spirit of *Sal Ammoniac*, prepared either from Sal Ammoniac with Quick-lime, or from Sal Ammoniac and Salt of Tartar, with common Water, and not with Spirit of Wine: Every Operator knows the Quantity; or, continue dropping in of ſuch Spirit upon the Liquor of the Phial often, till all Efferveſcence ceaſes, and all the acid Taſte, with the ſulphureous Smell, vaniſhes, being precipitated by the volatile *Alcali* to the Bottom.

3dly, Let the whole Liquor be rectified in a freſh Retort by a moſt gentle Heat of a *Balneum Mariæ*, or of an Hand as hot as that of a Perſon in a Fever; and then keep it for Chemical Uſes.

4thly,

The Doctor propoſed at ſome ſubſequent Meeting, to exhibit Four other ſimple *æthereal Spirits*, but of ſaline Origins, equally ſubtile with this æthereal Spirit of Wine.

Soon after this the Doctor died, and never diſcovered any thing relating to theſe elementary æthereal Liquors; only in a Paper he left in my Hands, he gave theſe few Hints of their Nature.

There are Four Spheres opened, one of the Earth, one of the Sea, one of the Air, and one of the Heaven.

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4thly, The inferior Liquor is to be purified as well as that which ſwam on the Top, but it muſt be done by Oil of Tartar *per Deliquium*, till all Ebullition intirely ceaſes: By evaporating all the Humidity of this Liquor, you will have a peculiar *Terra foliata Tartari*, which, being reduced into a *Calx*, ſhines in the Crucible like oriental Pearls, or a Peacock's Tail. This Earth has nothing of a pungent Taſte, and is to be eſteemed as a Sheet-anchor in the moſt ardent Fevers.

*N. B.* This Earth is of diverſe Colours, but it is not the common vulgar *Terra foliata* of Tartar; for it does not flow in the Fire, nor has the ſame Taſte as the common. The common is made by pouring diſtilled Vinegar upon fixed Salt of Tartar, till an intire Saturation is made. The Uſes of this were formerly known, and I know not by what Fate (ſays the Doctor) it is coming into Uſe again now. I thought proper to mention the Difference of theſe Preparations, becauſe I am able, from innumerable Experiments, to demonſtrate a real Diverſity in them. I ſhall ſeem to have dwelt too long upon one thing, but I hope I ſhall be the leſs blamed, ſince I deſign to ſhew, that there are ſeveral æthereal Liquors beſides this above-deſcribed; for there are not only ſuch (φλογιστικά, or) combuſtible Fluids, but there are likewiſe ſaline Liquors, and alſo ſome quite inſipid, being a Mixture of Combuſtibles differently graduated, and extracted by no other Heat unleſs their internal Fire. In a word, as many Spheres as there are of the Elements, ſo many æthereal, or (if you rather chuſe to call them ſo) aereal Liquids, *viz.* the Æther of the Earth, of the Water, of the Air, and of the Fire: Which, with the Leave of the Royal Society, I intend ſhortly to lay before them.

Whoſoever therefore knows how to extract the *Eſſences* out of Vitriol and Nitre, whoſe Centres are Salt, (and the Surface of the Earth is Salt),

1. Poſſeſſes the Salt of the Earth.

2. The Salt of the Sea is made from the Sphere of the Sea, and common Salt.

3. That of the Air is made of *Sal Armoniac* and Salts of Vegetables.

4. The Eſſence of Fire is made from and [illegible] from a concentrated Spirit of Wine, or of Vegetables. Thus the Four genuine Elements of Nature are obtained.

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## XXXII. *An Account of the* Fire-ball *ſeen in the* Air, *and of the* Exploſion *heard, on* Dec. 11. 1741. *by the Right Honourable the Lord* BEAUCHAMP, *near* London.

ON *Friday* the 11th of this Month, being on the Mount in *Kenſington* Gardens, at a Quarter paſt 10 o'Clock, the Sun ſhining bright, in a ſerene Sky, I ſaw towards the South, a Ball of Fire, of about Eight Inches Diameter, and ſomewhat oval, which grew to the Size of about a Yard and an half Diameter. It ſeemed to deſcend from above, and at the Diſtance of about half a Mile from the Earth, took its Courſe to the Eaſt, and ſeemed to drop over *Weſtminſter*. In its Courſe it aſſumed a Tail of Fourſcore Yards in Length; and before it diſappeared, it divided into Two Heads. It left a Train of Smoke all the Way as it went; and from the Place where it ſeemed to drop, there aroſe a Smoke which continued aſcending for 20 Minutes (as another Gentleman and I obſerved by our Watches); and at length formed into a Cloud, which aſſumed different Colours.

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## XXXIII. *A Letter from* John Fuller, *Eſq*; *jun.* F. R. S. *to Sir* Hans Sloane, *Bart.* *late* Preſident *of the* ROYAL SOCIETY, *concerning the ſame* Meteor, *in* Suſſex.

*Honoured SIR,*

YEſterday in the Afternoon, between Twelve and One o'Clock, all this Part of the Country was alarmed with a moſt terrible Clap of Thunder, as it is generally imagined. The Sound came from the North, where the Weather appeared very black and dark all the Morning. The Sound was double, as if Two very large Cannons had been diſcharged at the Diſtance of about a Second from one another: Moſt People thought, juſt at the firſt hearing, that it was the Diſcharge of Cannons, till by the rolling and echoing of the Sound afterwards, they were convinced it was not. Our Neighbours thought ſome Powder-mills had been blown up; and I look upon them to be no bad Judges in ſuch kind of Blaſts, having been more than once alarmed with them, by the Powder-mills in the Neighbourhood. I have it by Report, that a Countryman, at Work in the Fields about Seven Miles North of us, ſaw a Flaſh of Lightning before he heard the Noiſe, but I cannot anſwer for the Truth of it: It is very eaſy to imagine, that Fancy and Fear in a poor Countryman upon ſuch an uncommon Occaſion, might conjure up the Idea of Lightning. If it was Thunder and Lightning, the Effects of it muſt be very terrible ſomewhere; for it gave the ſame Report, and ſhook all the Houſes juſt in the ſame Manner, that were above [illegible] Miles diſtant from one another North and South; which I think is an Argument, that it was more general than Thunder can poſſibly be. I ſhould be glad to know whether or no it was perceived in *London*. I am,

*Honoured SIR,*

Roſehill, Dec. 12. 1741. *Your moſt dutiful Grandſon,*

J. Fuller.

## XXXIV. *A Letter from the Reverend Mr.* William Goſtling, *Minor Canon of the* Cathedral *Church of* Canterbury, *to Mr.* Peter Collinſon, F. R. S. *concerning the ſame* Meteor, *in* Kent.

*Canterbury, Sunday,*
*Dec.* 13. 1741.

*Dear SIR,*

ON *Friday* laſt the 11th Inſtant, about One in the Afternoon, I found my Houſe violently ſhaken for ſome Seconds of Time, as if ſeveral loaded Carriages had been driving againſt my Walls; and heard a Noiſe, which at firſt my Family took for Thunder, but of an uncommon Sound. For my own part, (as I thought Thunder which would ſhake us at that rate, would have been much louder) I concluded it an Earthquake: And, going immediately to the Top of my Houſe, found the Sky cloudy, but nothing like a Thunder-cloud in View; only there was a Shower of Rain from the Eaſtward preſently after, and the coldeſt that I have felt. I thought the Shock an Earthquake, as I told you before; but ſince find it was attended (and I ſuppoſe cauſed) by a Ball of Fire, which paſſed with great Rapidity over our Country, from Weſtward to Eaſtward, for how long a Journey I cannot tell. It began with Two great Blows, like the Reports of Cannon, (which the Jumbling of my Saſhes prevented my diſtinguiſhing); and then roll'd away till it was heard no more. The Appearance, I hear, was as that of a very large ſhooting Star; and it left a Train of Light, which ſoon diſappeared, it being Noon day. If this was a general thing, your SOCIETY will hear of it from all Parts; if only with us, I ſuppoſe this Account will give you ſome Pleaſure. It is the beſt I am yet able to ſend you: But I ought to tell you, I met a Pilot To-day, coming from *Deal*, whom I asked about it; and he told me he ſaw no Fire-ball, but heard the Noiſe, and that it made the Ship ſhake he was in, going from *Graveſend* to the *Nore*.

*Farewell.*

**W. Goſtling.**

*See more Accounts of this Matter in the next* Tranſaction.

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*Addenda to Page* 860.

This *Hypocauſt* may ſerve as a Model for *Malt-kilns*, or for drying *Hops*, &c.

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# Forty-firſt VOLUME
# OF THE
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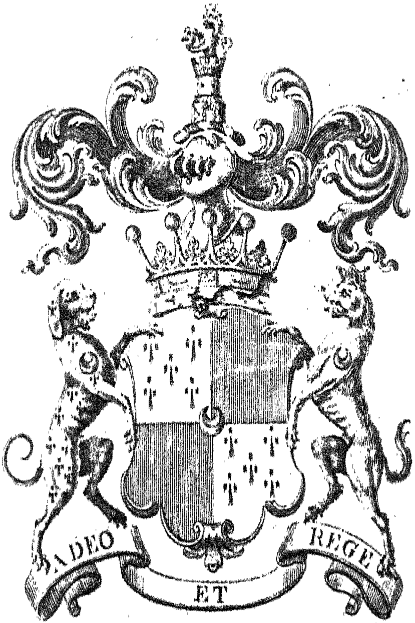

Philip Earl Stanhope.